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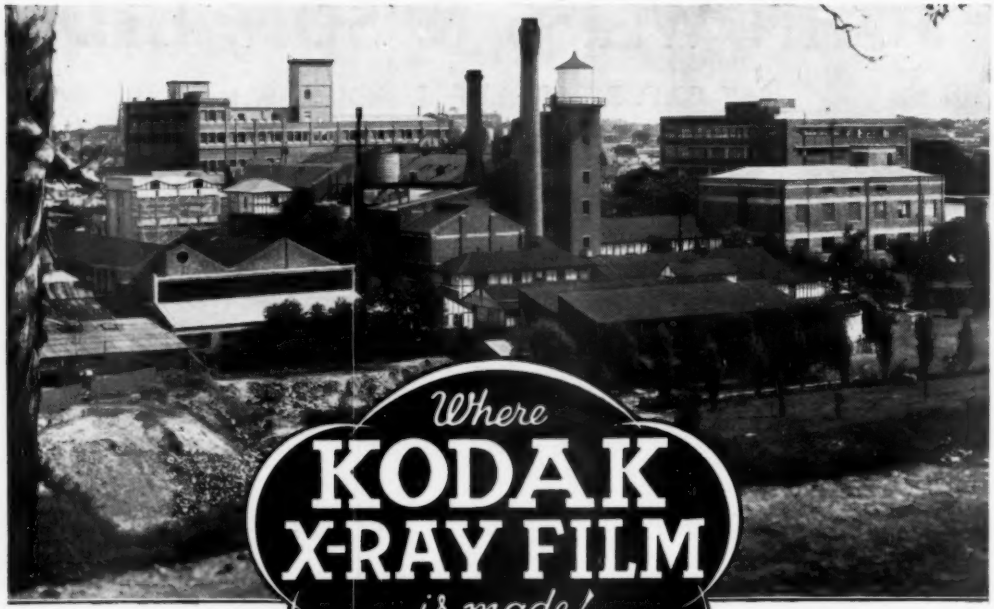

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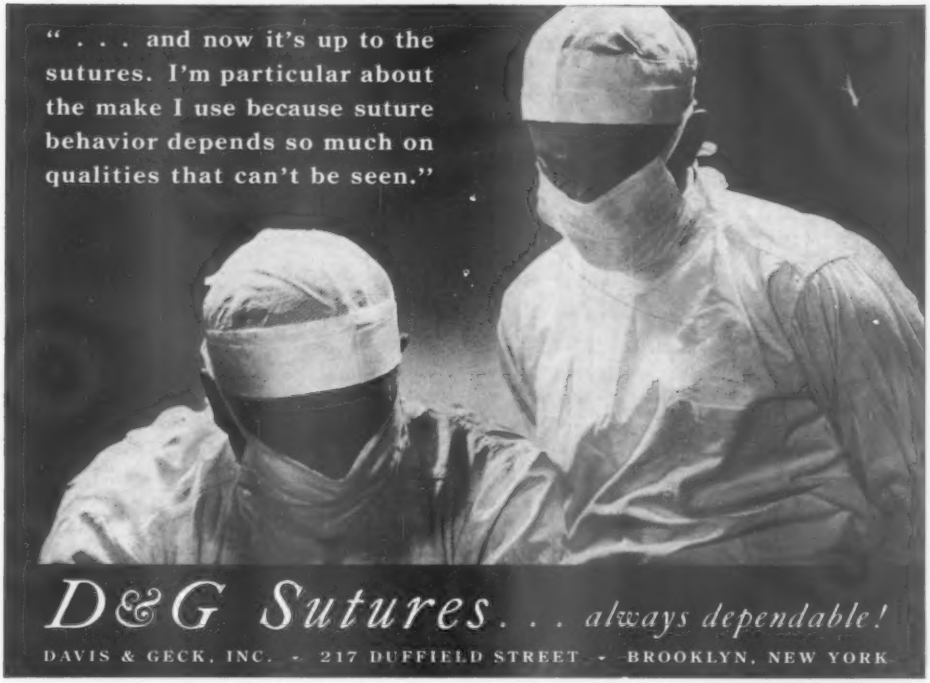
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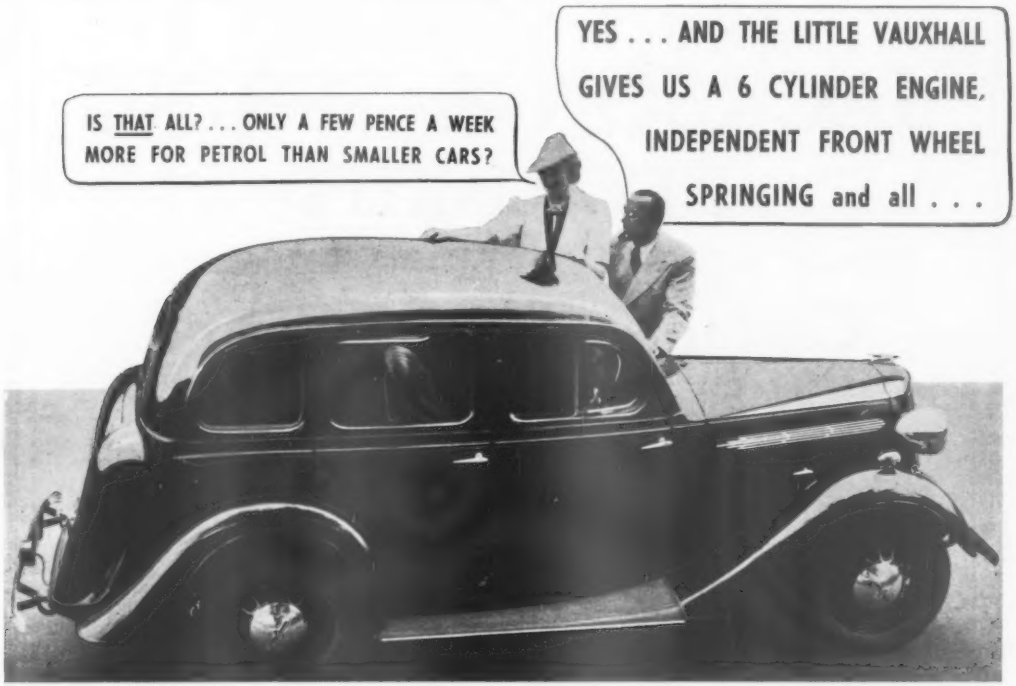
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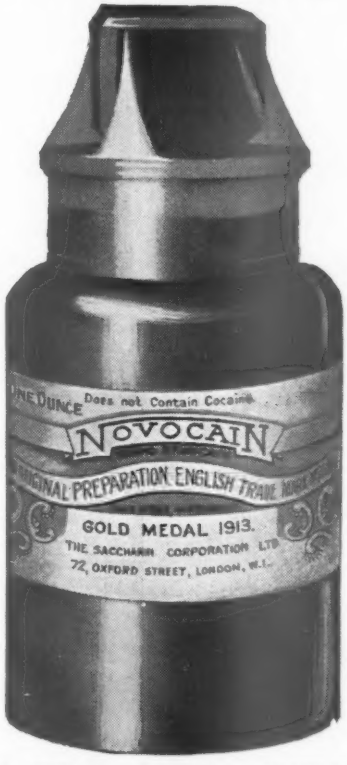

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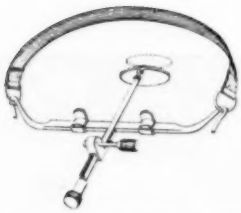

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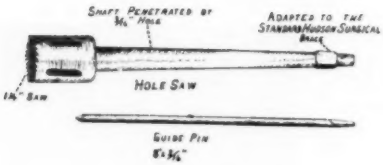

(*Journal of Bone and Joint Surgery*. July, 1937, page 706.)

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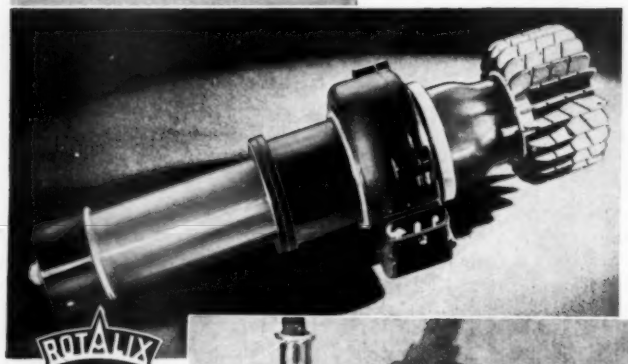

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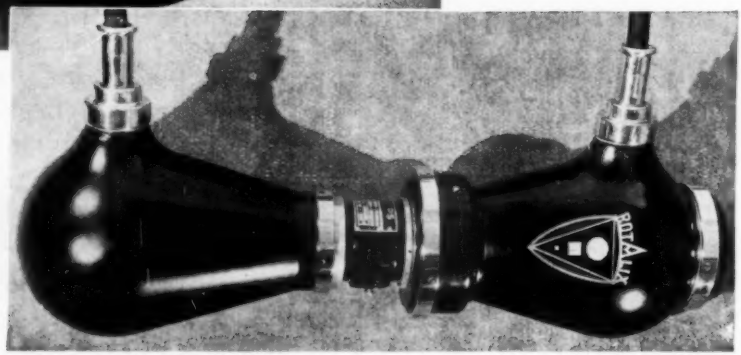

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The Australian and New Zealand Journal of Surgery

OCTOBER, 1937.

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THE HAMILTON RUSSELL MEMORIAL LECTURE.[1]

THE PHYSIOLOGY OF ACUTE CIRCULATORY FAILURE DUE TO HÆMORRHAGE AND SHOCK.

By SIR STANTON HICKS,
Professor of Human Physiology and Pharmacology, University of Adelaide.

THE large majority of those present still carry fresh in their minds a recollection of Hamilton Russell as they knew him. To me, studying under Gowland, he was one of those whose names were among the things to remember in anatomy and surgery, until I was honoured by the invitation to give this second lecture in his memory. Then it was that I looked into his life; and what I found was so arresting that it seemed to me that I was not the person to speak, because I had neither the necessary attainments nor the personal knowledge of him which might have made my references to his character more significant. There are scattered through the various journals, in Australia and in the United Kingdom, personal testimonies which can be made only to the truly great. Many are from old fellow students who had not seen him for years. They bear mainly upon his character, and they show that throughout his life, and quite apart from his acknowledged surgical eminence, he was one of whom it could be said: this was a man.

I have selected the topic of acute circulatory failure due to shock and hæmorrhage, not because I have made any contributions to the subject, but because it is exceedingly important that the surgeon should be aware of the physiological basis for the conditions to which it gives rise. When I say that, I do so fully realizing that, though there is much that we do know, there are yet a great many tangled threads of evidence to unravel. Nevertheless, a survey of the position at present

[1] Read at a meeting of the Royal Australasian College of Surgeons, Melbourne, on May 28, 1937.

is justified, and we could perhaps do no better than state the present views as recently expounded by a group of well-known investigators in this field before the Royal Society of Medicine.[1]

Holt defined the condition termed primary shock as a circulatory collapse due to inhibition of constrictor tone by influences operating throughout the central nervous system. It is rapid in onset, and associated with a fall in blood pressure, but without decrease in blood volume. The blood pressure may, for as much as an hour or two, remain too low to be recorded, provided the medulla is sufficiently supplied with blood. So far as secondary shock is concerned, Holt summarized Blalock's work, to which we must later refer in detail, and ascribed the condition to a reduction of blood volume, due to loss of blood and/or plasma into the injured tissues, leading to decreased cardiac output and fall in systemic pressure. The condition, he points out, will be adversely influenced by factors lessening the fluid reserves or retarding their passage into the circulation. Prolonged vaso-constriction may further reduce the blood pressure, and so establish a vicious circle.

Sir Henry Dale, in his contribution, emphasized the fact that so far all the conditions seen clinically as shock have not yet been experimentally repeated, and that the long range effect of products of tissue damage on capillary permeability has not been finally disposed of. Carlton, on the subject of toxic influence in this state, as the result of much clinical trial, concludes that repeated bleeding, with transfusion, in attempts to remove a possible toxin, is of no use; whilst Slome pointed out that subjects suffering from traumatic shock are sensitive to hæmorrhage, whether the latter is caused by the trauma or not.

The foregoing summary of the cardinal points in our knowledge of this clinical state serves as an excellent starting point for a physiological analysis of the terms used and the data from which conceptions have been deduced.

The difference between primary and secondary shock is so clear cut in period of time as to offer no difficulty in differentiation. The blood pressure fall is common to both, but the blood volume is involved, according to the previous statement, only in secondary shock; according to Blalock, however, this is true only in the early stages, since later, as the pressure remains low, the cardiac output diminishes owing to loss of blood volume.

At this juncture it is obvious that we must be more explicit. What does "blood volume" mean, and how is cardiac output controlled?

To be strictly accurate we must distinguish between "circulating blood volume" and "total blood volume", and it was perhaps the work of Barcroft on the depôt function of the spleen that first gave us concrete evidence for such a conception. Since that date the depôt function has been found to reside also in the great veins, and particularly in the liver veins, whilst the pulmonary circulation serves as a buffer depôt between the right and left sides of the heart itself. According to Meek and Eysters, the subpapillary plexus of the skin is another blood

depôt, and our own observations on the naked aboriginal support their view.

The demonstration by Fleisch of venomotor nerves and their effect on the calibre of veins—especially the greater veins—and the further demonstration by Pick and Mautner of the damming back of the blood in the liver by means of veno-constriction at the exits of the liver veins, have established a sound basis for the extension of Barcroft's conception of blood depôts. We know, in fact, that but for the presence of such depôts the demands made for oxygen in excessive muscular activity could not be met even with the rate of cardiac output at its greatest. By diminishing the volume of these depôts we increase the circulating blood volume, and therefore the amount of hæmoglobin available for oxygen transport, and reverse the effect upon cardiac rate that is produced by loss of circulating blood volume through hæmorrhage.

So we see that in discussing blood volume it is not enough to think in terms of the total blood in the body. We shall see that it is just in the phenomenon of shock that this care is most essential, for without depletion of the total blood in the animal circulatory blood volume may be diminished to a fatal extent.

This brings us to the subject of cardiac output. Cardiac output depends fundamentally upon the venous return to the right heart, and the rate of heart beat is determined by the physiological capacity of the heart muscle to contract with optimum effect in the expulsion of the blood from the left ventricle. Increased cardiac rate, at rest, in the circumstances we are discussing indicates reflex loss of vagal tone, due to falling pressure in the aortic arch and carotid sinus. Prolongation of the low pressure will further raise the rate owing to failing coronary circulation and the need for further diminution of the content of the ventricle during diastole. It is obvious that within limits we may maintain the output per minute with varying cardiac rates; but it is also obvious that, as the rate increases, the output per beat falls below the point where the output per minute is adequate to maintain the normal systemic pressure. It is at this point that the blood pressure falls, and this combined fall in minute volume and blood pressure is the cause of the small, feeble, and rapid pulse.

It is no less important for the surgeon than for the physician that this fundamental physiology of the heart be thoroughly understood. It throws into high relief the main points to be borne in mind in dealing with subjects suffering either from much loss of blood, or from the condition known clinically as shock. The heart must be richly supplied with blood if it is to fill the systemic circulation; and the ultimate mechanism for dealing with this supply is the cardiac muscle, which varies its force of contraction in response to the degree of filling of the ventricle in diastole.

I have stated that the cardiac muscle must get a good supply of blood. In extreme conditions this supply rises to as much as five cubic centimetres per gramme of muscle, which means, for an average heart,

1,500 cubic centimetres per minute in extreme effort or, roughly speaking, 20% of the output of the left ventricle. This flow is dependent upon the mean pressure in the aorta during diastole and early systole. Should this pressure fall—as it will if the venous return is diminished—then the cardiac muscle itself is in danger owing to the lessening of the coronary flow per minute. Cardiac muscle, unlike skeletal muscle, is unable to go into temporary "oxygen debt", as the expression goes, in order to tide itself over any extra demands. A sprinter may, in order to achieve a record, perform more muscular work than the oxidative processes of his musculature are able to "cover". These, however, are merely delayed until the effort is past; hence the term "oxygen debt". Cardiac muscle being so situated, the importance of an effective coronary supply cannot be over-estimated, and the time factor will play a great rôle in this feature of the clinical picture which we are considering. Thus we find that, owing to depleted coronary flow, the state of nutrition of the cardiac muscle is such that the response to increased initial length of fibre is much less than is normally the case. That is, we are now dealing with a heart whose intrinsic adjustment is impaired. If now, for any reason, sudden extra filling of the heart is brought about either from the venous side or by embarrassment to the output, we have the equivalent of extra work suddenly demanded of the heart muscle, which for the moment cannot go into "oxygen debt" and may fail completely to empty the left ventricle, causing syncope.

The same effect may be produced by the opposite cause, namely, acute failure of the venous return for any reason, or of the systemic pressure owing to vasomotor inhibition. The consequent drop in coronary blood pressure may again rapidly lead to such change in the heart muscle as to make resuscitation impossible.

Time, therefore, is the very essence of this matter of dealing with circulatory failure, which in the end leads to myocardial failure, and, bearing in mind these first principles, we may now consider the evidence, clinical and experimental, on which have been based conclusions concerning both the nature of the condition known as circulatory failure and the best means of combating it.

Let us consider the clinical signs of the three main causes of circulatory failure with which we are dealing. Primary and secondary shock and hæmorrhage have in common a severe fall in blood pressure, rapid feeble pulse and shallow respiration. Is there a common cause? The onset in primary shock is quite sudden, and is associated with either no loss of blood or a loss which at the stage of onset is quite small. Goltz,[2] so long ago as 1863, drew attention to the circulatory failure induced by severe handling of abdominal viscera which caused vagal slowing of the heart and vaso-dilatation in the splanchnic area, with fall of blood pressure. The condition which he concluded was a syncope, led to much confusion on the subject of shock as a whole, for the results of his frog experiments were transferred by theorists to explain secondary traumatic shock in man. It was found, for example,

twenty years later that in animals dying of traumatic shock the abdominal vessels were not dilated, but, on the contrary, empty. Blalock, to whom we owe much for the clarification of this subject, is prepared to accept Goltz's experimental work as a basis for deducing diminished constrictor tone as the cause of the acute condition known as primary shock. And this, too, is the position adopted by Holt,[3] as stated at the beginning of the lecture.

Because secondary shock may develop from this primary syncope, many were led to seek an extension of the same causes in explanation. Among the most noteworthy of these investigators, and one to whom surgery owes much for his improvement in technique aimed at diminishing reflex nervous trauma, stands George Crile,[4] of Cleveland. It is his theoretical justification for his results that have come under criticism, and, in particular, his experimental support of the theory of the origin of shock as being due to nervous exhaustion.

In 1914, whilst F. C. Mann[5] was still at Johns Hopkins Hospital, he had largely proved that unless the abdomen was opened it was impossible to produce shock in an anæsthetized animal so long as no hæmorrhage was caused. In other words, the avoidance of splanchnic dilatation, or of gross loss of blood, seemed to be the important thing. And that is the end of the pre-war period.

With the War and unprecedented surgical experience of the phenomena of shock and hæmorrhage, we enter upon the phase of our subject which may be properly termed modern.

The condition of secondary shock to which we may now turn, was responsible for so much disaster in the face of valiant surgical skill that His Majesty's Government ordered inquiries into its nature and causation. The cardinal clinical facts remain the same, but it soon appeared that the fall in blood pressure could not be explained on the assumption of the existence of vasomotor paralysis. The vaso-constrictor tone is increased, not lessened, the heart is accelerated and beating vigorously, but the pulse is feeble. So we find in Captain N. M. Keith's report[6] to the Medical Research Council in 1918 that the condition of secondary shock is almost identical with that of hæmorrhage in its clinical picture; it is, indeed, a condition of defective circulation, the cause of which is to be sought in the availability of blood for distribution by the heart pump. In this report we find established a close relationship between blood volume and the severity of symptoms, together with an important correlation with these of blood dilution as measured by the corpuscular volume. Persons who recovered spontaneously, that is, with administration of fluids and application of warmth, had pulse rates of 120 to 140 per minute and blood pressures over 90 millimetres of mercury, whilst the blood volume had not sunk below 65% at the lowest. The blood dilution due to passage of water from the tissues was from 70% to 80%. Below these limits treatment was practically without result. Above these limits blood transfusion, or gum saline infusion, hastened recovery and reduced operative risk. It will be seen from this

brief incursion into the quantitative data that the differentiation between shock and hæmorrhage as a cause of the clinical syndrome begins to depend upon the question as to whether fluid is entering or leaving the blood stream. More recent work shows that the time factor introduces a source of conflict between various experimental results in so far as corpuscular concentration is the sole means of differentiation. Bearing in mind this criticism, into which we shall go later, we must consider the factors governing fluid interchange between undamaged capillaries and the tissues.

Water is carried in the blood chiefly as water of imbibition by the colloid particles of the serum albumin. This equilibrium between imbibed and free water depends upon the hydrostatic, that is, the blood pressure. In the arterial limb of the capillary loop the pressure of 32 millimetres of water is high enough to cause an outflow of fluid into the intercellular spaces; whilst on the venous limb the reverse is the case: the colloid-osmotic pressure of the plasma protein (25 millimetres of water) exceeds the venous pressure and fluid is taken up, the whole with the lymph drainage maintaining a steady average state. Loss of blood by hæmorrhage means loss of plasma protein, and therefore loss of colloid-osmotic or imbibition pressure, with the result that fluid is lost to the tissues. The systemic pressure, however, has fallen too, and in consequence fluid may still enter the venous limbs of the capillaries. Clearly we are dealing with opposing factors (to which are added vasomotor influences) and the possibility of much confusion in analysing any set of experimental conditions. The effect of intravenous transfusion of blood or infusion of gum and saline solution has its explanation in the restoration not only of blood pressure, but of colloid-osmotic pressure, owing to the presence of the plasma protein and the gum acacia respectively.

Whilst Keith was engaged upon this work, Cannon and Bayliss[7] were investigating the phenomenon from the experimental side. Their work, which is embodied in Medical Research Council Report 26, 1927, aims at establishing the part played by tissue trauma in the production of the shock syndrome. In the same report is a contribution of McNee, Sladden and McCartney on the clinical aspect of the problem, and one of their findings is important at this juncture. They state that "cases of multiple small muscle injuries from bomb explosions have died probably simply from shock"; and that "muscle damage is only one of many factors involved".

Using cats anæsthetized with urethane, Cannon and Bayliss caused severe experimental trauma to the muscles of the hind leg, often involving bone fracture. There resulted at first a steep fall in blood pressure, followed by a slower continuous fall. At first the steep fall was thought to be due to the central nervous effect, but transection of the cord did not prevent it—in fact, it rather increased it—whilst clamping of the aorta was effective. Note this rather important result which only recently has been properly interpreted. There was a dilution of the

blood, due to falling blood pressure, and influx of tissue fluid, and the *post mortem* weights of the limbs showed an increase in the injured limb amounting to only 10% of the total blood weight. Severance of the nerves to the limb at their emergence from the lumbar cord did not prevent the fall in blood pressure, whilst ligation of the blood vessels was effective. Removal of the ligature after such procedure was followed at once by the fall in systemic pressure, and the conclusion was that some toxic vaso-dilator substance from the damaged tissue had gained access to the rest of the body. Here we see the stage set for the enactment of the scene entitled: "The Toxic Theory of Causation of Shock."

Medical Research Council Report Number 26 embodies the extensive and important experimental work of Dale, Laidlaw and Richards,[8] who showed that the ultimate effect of injection of histamine into cats anæsthetized with ether is to produce a condition analogous to that found in secondary shock, with vigorously beating, but empty, heart, associated with empty arteries and veins, but widespread congestion of capillaries. Enormous doses of histamine are without effect, however, on either the unanæsthetized cat or one under nitrous oxide anæsthesia; and hæmorrhage notably increases the susceptibility to the histamine effect even after the animal has recovered from it. In view of Sir Henry Dale's recent statement given earlier in this discourse, these facts should, I think, be borne in mind. They both indicate that interference with cellular metabolism, either by way of metabolic poisons, of which ether and chloroform are examples, or by anoxia resulting from loss of blood, reduces the subject's organized protective responses. Fundamental work such as is at present in progress at the Walter and Eliza Hall Institute, on the liberation of histamine from tissue cells, is likely to contribute much to this difficult aspect of the problem of shock in general, and that of anaphylaxis and allied forms in particular. At the present moment it would appear that the experimental evidence is unfavourable to the conception of a toxic influence as being paramount in producing secondary shock. The capillary dilatation and consequent fall of blood pressure, with loss of fluid to the tissues, have not been obtained by Smith[9] in cross-circulation experiments, in which blood from the damaged limb passed to a second intact animal in which no effect was noted. The same investigator showed that the peripheral vasomotor mechanism may be involved in shock, because after paralysis by ergotoxine of the sympathetic pressor response the effects of injection of histamine or of intestinal trauma or hæmorrhage are more severe. It is this type of result which, I think, should emphasize Sir Henry Dale's plea for an open mind on the subject of long range effects of possible liberated substances. It might be said that with the work of Blalock[10] and his Vanderbilt school, as reviewed in 1934, the recent period of investigation into the causes of secondary shock has truly begun. We enter upon this period with a knowledge that the low blood pressure in shock is due to loss of circulatory blood volume; that it is not, as

once supposed, due to vasomotor inhibition. The matter to be decided is: what is the cause of this loss of circulating blood volume if gross hæmorrhage is not apparent, and what are the differences, if any, between shock and hæmorrhage that may be made use of in ensuring better diagnosis and treatment?

Repetition of the experiments of Cannon and Bayliss by Blalock, and by his colleagues Parsons and Phemister,[11] established two highly significant facts. First, that the amount of swelling of the traumatized limb is quite adequate to account for the loss of circulating blood volume, either as plasma when the blood became concentrated or whole blood when it became diluted (this is important when corpuscular volume measurements are made a basis for study). In fact, they showed that enough fluid volume was lost to cause death from hæmorrhage alone. If the veins from the limb were ligated and the artery was alone left intact, trauma caused the same loss of blood volume; whilst if both artery and vein were ligated no shock resulted. (Blalock, 1930.)

Secondly, by transfusing normal animals with blood taken from shocked animals, Blalock was able to confirm Smith's results, which could not establish the presence of a toxæmic causal agent; whilst, using spinal anæsthesia, he could establish no essential difference in reaction. A logical extension of this disclosure of fluid loss into the traumatized tissues is to be found in the study of the effect of extensive burns, and here, too, Blalock found that the blood became concentrated, whilst the fall in blood pressure could similarly be equated with the drop in circulating volume due to fluid loss into the blistered area (1931).

The degree of injury determined whether plasma or blood was lost into the damaged tissues, and it could be demonstrated that even when it was mainly a plasma loss from which the circulation suffered, it could be sufficient to cause death (Blalock and Beard, and also Johnston and Blalock, 1931).

The blood pressure falls at a rate dependent on the rapidity of the loss of blood or plasma into the injured area, although the output per beat of the heart falls steadily from the outset. This is due no doubt to increase in vaso-constrictor tone caused by stimulation of pressor endings in the carotid sinus. The amount of blood found *post mortem* in the visceral vessels was only one-half of that found after death from other causes, including histamine shock; whilst, on the other hand, if the hæmorrhage was very slow, capillary hæmorrhages and intense congestion of the splanchnic vessels were the result. Here, again, we find the basis of apparently contradictory findings in the literature, and none is better exemplified than the effect of the rate of hæmorrhage upon corpuscular concentration. In animals bled slowly, and transfused with blood to prolong life, the end result prior to death was a concentration of the erythrocytes.

Splanchnic capillary congestion and even hæmorrhage into the intestines were found at death in these cases.

Reverting, therefore, to the differentiation of shock and hæmorrhage so often given, we find that there is, as usual in such instances, some truth in the statements regarding blood dilution, but that closer analysis shows that the end result depends upon whether or no sufficient survival time has elapsed for anoxia of capillary walls to set up the congestive picture. In tissue damage the fluid lost is largely plasma, particularly if no large vessel is torn, and the result is a concentration of corpuscles which is too rapid to be marked by the passage of fluid back into the blood from uninjured tissues. On the other hand, loss of much blood from a large vessel gives the expected dilution picture.

In practice, the hæmorrhage subject either dies from the excessive loss, or the bleeding is controlled and restorative measures are adopted early. In such cases at *post mortem* examination we should find the anæmic condition of the viscera usually described. In cases with multiple wounds, as cited by McNee and his colleagues, in which there is considerable loss of either blood or plasma into the tissues, the fall in blood pressure is slow in onset, and the tissue anoxia is well developed in the terminal stages, with the result that engorged splanchnic vessels and hæmorrhages are seen at autopsy. So disappears another allegedly cardinal difference between hæmorrhage and shock.

O'Shaughnessy and Slome[12] have since confirmed the results of the American investigators, and have shown that if the crushed limb is amputated so as to include the higher muscles at their origins, the small increase in weight found by Cannon and Bayliss can be explained, for by this procedure up to 50% of the total blood volume can be found to have passed to the damaged limb. They adduced some evidence in favour of an additional nervous factor, and recommended spinal anæsthesia to gain this objective; but in view of Blalock's failure to demonstrate such an effect, and because the fluid loss is of paramount importance, we may reasonably await further confirmation of these results.

The shallow respiration which is characteristic of the clinical picture, is due to anoxia of the respiratory centre. It produces a vicious cycle of results in that shallow respiration itself, by causing ineffective ventilation of the lungs, adds to the anoxæmia. At the same time, by ceasing to act as an effective pump on the venous return via the large veins to the heart, the cardiac filling is further impeded.

The vaso-constriction resulting reflexly from the drop in blood pressure, affects the extrasplanchnic vessels mainly in the musculature and skin, thus at first increasing circulatory volume; later, however, the vasomotor centre is more extensively stimulated by the rising degree of anoxia in the medulla, and, as a result of the consequent stimulation of the suprarenals, circulating blood volume is actually lost owing to damming back of blood in the liver by the throttling of the outflow from the liver veins.

As long ago as 1914, Sollmann,[13] and, in 1917, Erlanger and his associates, had shown that vaso-constriction was always present in

experimental shock, although they were unable to prove what they believed, namely, that this vaso-constriction might, if sufficiently intense and prolonged, actually predispose to the development of shock. This would occur owing to diminished flow to the capillaries, in which stagnation could occur, so depleting the venous return to the heart. Freeman,[14] working in Cannon's laboratory, has established the fact that cold, excitement, asphyxia and hæmorrhage all predispose to shock by evoking hyperactivity of the sympathetic side of the vegetative regulation. This causes extensive vaso-constriction in the skin and splanchnic area, and also reduces the portal venous return from the liver, owing to the throttling action at the exits of the hepatic veins.

Both by cerebral excitement, simulating rage, and by continuous injection of large but physiological amounts of adrenaline, the blood volume was reduced by 22% to 27%—a result which could not be produced after the previous injection of ergotoxin. This drug prevents the action of adrenaline, whether secreted by the adrenals or by the adrenergic terminations of the sympathetic pressor fibres, and the effect is exactly the same as that produced by sympathectomy, as this investigator was able to demonstrate.

If we add to these primary causes of over-stimulation of the sympathetico-adrenal system, as Cannon[15] terms it, that due to increasing anoxia of the vasomotor centre as the loss of circulating volume progresses, as well as that due to the consequent progressive stimulation of the pressor receptors in the carotid sinus and aortic arch, due to falling systemic pressure, we are forced to conclude that we are here dealing with a prime cause of shock.

As Blalock has shown, the *post mortem* circulatory findings in the splanchnic area depend upon anoxia of the vessel walls, and Freeman has suggested an extremely plausible explanation in the capillary stasis induced by intense vaso-constriction, with resulting anoxia of the capillary wall, loss of fluid, and of gross blood into the lumen of the intestine. This would also explain the dusky appearance of the skin and nail bed, and the high corpuscular concentration in the superficial capillary blood. But this is not all that results from the excessive action of the sympathetic side of the vegetative system. Quite recently, Cannon has confirmed earlier work which had shown that the blood vessels of skeletal muscle are dilated by intense activity of the sympathetico-adrenal system. The effect of this is much greater than may be imagined, for, as Krogh[16] and his students have shown, resting muscle is served by a minimal and constantly changing number of capillaries per unit of volume; and any influence which will dilate the capillaries, increases at least ten times the capacity of the capillary bed. Should this increase result either from massage or from muscular activity, the increased lymph flow so resulting would be moved via the lymphatics into the general circulation. It is Cannon's belief that the dilatation of vessels supplying the musculature leads, owing to increased filtration pressure, to passage of fluid into the tissue spaces, where, in

the immobile patient, it remains as a loss to the circulating volume. He suggests that instances of death from shock without any injury whatever, in which the classical signs of shock have been present for forty-eight hours, may well be explained by this overactivity of the sympathetico-adrenal system.

The principles underlying prevention and treatment of shock and hæmorrhage are, therefore, the maintenance of the circulatory blood volume, the avoidance of extra demands upon the circulation, and so the heart, and the mitigation or avoidance of any influence likely to stimulate the sympathetico-adrenal system or to undermine the metabolic resistance of tissue cells.

Under the first heading we have in the first line dehydration. There is normally a rather unexpectedly large fluid loss from the body in the form of invisible perspiration and water vapour from the lungs, amounting to 2,000 cubic centimetres a day, to which must be added any urinary secretion; whilst intestinal disturbance may be responsible for failure to reabsorb secretions passed to the bowel. Purgation prior to surgical operation must, therefore, be avoided. Excessive perspiration, such as results from excessive sympathetic stimulation following severe trauma, is to be remembered as another source of fluid loss. These losses should be added to the blood or plasma loss, when they assume considerable importance as limiting factors. (Coller and Maddock,[17] Freeman *et alii*.[18])

The question of osmotic pressure of the plasma protein comes into this section, and, when possible, it should be restored either with blood or imitated by gum saline solution. It is essential that this step be taken early, for, as we have seen, it is ineffective after tissue anoxia has developed to any considerable extent.

Under the second heading we place those measures taken to ensure warmth, and to prevent any movement either due to pain or apprehension or if the subject is as yet unaware of the danger of his condition. Quiet is essential. All these precautions keep down any extra demands on the circulation, even for the production of heat to replace loss due to cooling. It is necessary to bear in mind the effect of overheating the patient, as, for example, by the shock cradle, because the increased flow of blood to the skin brought about by the heat regulating mechanism may, in severe cases of depleted circulatory volume, further diminish the cardiac filling and lower the blood pressure (Rein). All that is necessary is to prevent heat loss, not to heat the patient.

The third group of factors includes such influences as are known to predispose to shock. Blalock and his colleagues have confirmed these experimentally, and they are starvation, exposure to cold, and prolonged anæsthesia. He was, in fact, able to reproduce in dogs, by prolonged anæsthesia, the same effects as those caused by slow continued bleeding. Autopsy disclosed the typical splanchnic congestion and hæmorrhage into the bowel. Clearly the excessive action of the sympathetico-adrenal system is important here.

The investigators at Vanderbilt University also studied the effect of injected crystalloid solutions. If the blood pressure has been depressed for an hour or more, the infusion of saline or glucose solution leads to loss not only of injected fluid, but also of plasma. If blood is injected, there is a similar loss of plasma, but the end result is not as in the first case, a dilution of the plasma protein, but either a gain or, at all events, no loss. The addition of adrenaline or pituitrin to the infusion does not lessen the rate of loss of plasma protein. In another excellent paper, McFee and Baldridge[10] draw attention to the importance of dehydration as an ætiological factor in secondary shock, and claim that large quantities of saline solution may be given with great advantage to cardiac output and blood pressure. They claim that there is no danger to the heart, nor any likelihood of pulmonary œdema arising from such procedure. Close reading of the experimental details, however, discloses the fact that the infusion of these large amounts follows closely upon the bleeding, and therefore before tissue anoxia has had time to develop. In fact, their work—apart from their unqualified conclusions therefrom—supports the contention of Blalock and all other workers in this field, that for treatment to be effective it must be prompt—the more so, the more severe the injury.

This brings us finally to the question of the blood pressure itself as an index of treatment. Freeman has very recently emphasized the vasomotor factor in a series of experiments in which again Blalock's conclusions are confirmed. Freeman demonstrated conclusively that the fall in blood pressure due to the injury and fluid loss, causes overaction of the adrenal glands. Infusion by raising the cardiac output and blood pressure, inhibits through the carotid sinus reflex adrenaline secretion which, as previously stated, diminishes circulatory blood volume. We have already considered the detailed physiology of this phenomenon, and it is necessary in this place only to indicate, therefore, an additional and cogent reason for early restoration of blood volume. Freeman also favours, as the result of experimental proofs, the gum saline or blood transfusion as giving more lasting and therefore more valuable effect than non-colloidal solutions.

Attempts to raise blood pressure temporarily by vaso-constrictors are thus seen to be not only unnecessary in secondary shock, but actually unfavourable; the main thing is to restore to the heart a good venous return. In primary shock, however, their use is quite justified by the more sustained effect which they have upon the systemic pressure. There has been much controversy concerning the use of morphine. Its value depends upon the stage at which the subject comes under treatment. In the early stage, when the diagnosis is certain, it should be administered as a preventive measure, since it stops all movements due to pain, which are likely to increase (*a*) the loss of blood or plasma into the damaged area, and (*b*) the demands upon the heart due to muscular response and emotional interference with cardiac rate, whilst

it lessens the activity of the sympathetic system and the consequent vaso-constriction.

It is, however, a most powerful depressant of the respiratory centre, even in small doses, and would therefore appear to be a dangerous drug to use in the later stage, when shock is developing and the respiratory centre is depressed by anoxia. From the literature which I have studied I am unable to find any sound evidence that small doses of morphine, by depressing the respiratory centre still further, cause better pulmonary ventilation in shock.

It is true that in the complex set of conditions associated with paroxysmal nocturnal dyspnœa arising from left ventricular weakness, the administration of morphine has this effect. The accumulation of carbon dioxide caused by the depressed sensitivity of the centre breaks a vicious circle ending in periodic breathing in these cases, and the better ventilation of the lungs removes the original anoxic cause.

I mention this only because the use of morphine is so general and so necessary in dealing with cases likely to develop shock, and because such controversy as does exist is to my mind due to the emphasis being laid by participants on either the early or the late stage of treatment.

Since prevention is our main hope, the use of morphine properly comes under the heading of preventive measures, and aims at producing the same results as that recently emphasized by Gibson, of Saint Vincent's Hospital. I refer to the necessity for handling the patient as little as possible immediately after operation. The vasomotor system in the unconscious subject is inefficient, and the total blood volume is depleted. Movement, by shifting the circulating blood suddenly, can so interfere with venous return as to cause circulatory collapse. The situation is quite analogous to that in which an almost empty petrol tank will, owing to inequalities of gradient, cause intermittent supply to the petrol pump and carburettor.

The decision, then, as to when to use morphine must be based upon clinical experience, cognizance being taken of the object to be gained by its use, and the possible respiratory disadvantage at the given clinical stage being weighed against the need for preventing movement and quelling sympathetico-adrenal activity and cardiac irregularity from emotional causes. The intravenous use of strophanthin, or of digitalis, is manifestly of no value, since it is useless to attempt to stimulate the heart to greater effort when that organ is doing its utmost, but receiving diminishing supplies of blood to distribute. It is extremely important to emphasize, therefore, not the use of drugs, but the value of early restoration of fluid lost by blood transfusion or by injection of gum saline solution; and if the difference between total blood volume and circulating blood volume has been satisfactorily grasped, it will be realized that when all depôts have finally been drawn upon, the venous return may still provide sufficient cardiac filling to maintain a nearly normal blood pressure. Most rigid hæmostasis must nevertheless be

observed, for further loss of blood may with dramatic suddenness precipitate the subject into a condition of severe shock.

In conclusion, I would draw your attention to the classification of shock at the end of the excellent address of Blalock in *Surgery, Gynecology and Obstetrics* ("International Abstracts of Surgery") for 1934. If I have been able satisfactorily to present the existing knowledge of this dramatic condition of secondary shock, its physiology and its relation to the effects of hæmorrhage, I shall feel that I have dealt with a subject not unworthy in surgical importance for such a memorable occasion as this second lecture in honour of Hamilton Russell.

ADDENDUM.

Since this paper was prepared exact physiological and extensive clinical information has become available concerning Knoll H_{75} (1–p–oxyphenyl–2–methylamino–propane), or "Veritol". This substance is the nearest approach so far obtained to the ideal physiological restorative of the circulating blood volume, provided the depôts are not depleted. It acts upon these—not upon the vessels—and it enhances cardiac efficiency where this is low. Its effect on blood pressure lasts twenty times as long as that of adrenaline, and does not exceed the normal level, since, unlike adrenaline, it does not throw the carotid sinus and aortic throttles out of action. In severe circulatory collapse after operations for cerebral tumour, ileus, rectal or gastric resection, and following lumbar anæsthesia, it has proved most effective (*vide* H. Rein, *"Die physiologischen Grundlagen für die Wirkungsweise der Versuchs-substanz 'Knoll H_{75}'"*, *Klinische Wochenschrift*, Volume xx, 1937, page 700; and D. Schneider, *"Klinische Erfahrungen mit dem Kreislauf-mittel 'Veritol'"*, *Klinische Wochenschrift*, Volume xxi, 1937, page 736).

REFERENCES.

(1) R. L. Holt, H. H. Dale, H. Carlton, H. E. D. Gale and D. Slome: *Proceedings of the Royal Society of Medicine*, Volume xxvii, 1935, page 1473.

(2) Fr. Goltz: *"Über den Tonus der Gefässe und seine Bedeutung für die Blutbewegung"*, *Archiv für pathologische Anatomie und Physiologie*, Volume xxix, 1864, page 394.

(3) R. L. Holt and A. D. McDonald: "Observations on Experimental Shock", *The British Medical Journal*, Volume i, 1934, page 1070.

(4) G. W. Crile: "An Experimental Research into Surgical Shock", 1899; "Anoci-association".

(5) F. C. Mann: "The Peripheral Origin of Surgical Shock", *Bulletin of the Johns Hopkins Hospital*, Volume xxv, 1914, page 205.

(6) N. Keith: "Blood Volume Changes in Wound Shock and Primary Hæmorrhage", Medical Research Council, "Special Report Series", Number 27, 1919.

(7) W. B. Cannon and W. M. Bayliss: "Note on Muscle Injury in Relation to Shock", Medical Research Council, "Special Report Series", Number 26, 1919; "Traumatic Shock", 1923.

(8) H. H. Dale, P. P. Laidlaw and A. N. Richards: "The Action of Histamine: Its Bearing on Traumatic Toxæmia as a Factor in Shock", Medical Research Council, "Special Report Series", Number 26, 1919; "Histamine Shock", *Journal of Physiology*, Volume lii, 1919, page 355.

(9) M. I. Smith: "Studies in Experimental Shock", *Journal of Pharmacology and Experimental Therapeutics*, Volume xxxii, 1928, page 467.

(10) A. Blalock: "Acute Circulatory Failure as Exemplified by Shock and Hæmorrhage", *Surgery, Gynecology and Obstetrics*, Volume lviii, 1934, page 551 (with very complete bibliography of Blalock and others).

(11) H. Parsons and D. B. Phemister: "Hæmorrhage and Shock in Traumatised Limbs", *Surgery, Gynecology and Obstetrics*, Volume l, 1930, page 196.

[12] P. E. O'Shaughnessy and D. Slome: "Ætiology of Traumatic Shock", *British Journal of Surgery*, Volume xxii, 1935, page 589.

[13] J. D. Pilcher and T. Sollmann: "Studies on the Vasomotor Centre: Effects of Hæmorrhage and Injection of Blood and Saline", *American Journal of Physiology*, Volume xxxv, 1914, page 59.

[14] N. E. Freeman: "Decrease in Blood Volume after Prolonged Hyperactivity of the Sympathetic Nervous System", *American Journal of Physiology*, Volume ciii, 1935, page 185.

[15] W. B. Cannon: "A Consideration of Possible Toxic and Nervous Factors in the Production of Traumatic Shock", *Annals of Surgery* ,Volume c, 1934, page 704.

[16] A. Krogh: "The Anatomy and Physiology of Capillaries", 1929, page 271.

[17] F. A. Coller and W. G. Maddock: "Dehydration Attendant upon Surgical Operations", *The Journal of the American Medical Association*, Volume xcix, 1932, page 875; "Water Requirement of Surgical Patients", *Annals of Surgery*, Volume xcviii, 1933, page 952.

[18] N. E. Freeman, R. S. Morison and L. Sawyer: "Effect of Dehydration on Adrenal Secretion and its Relations to Shock", *American Journal of Physiology*, Volume civ, 1933, page 628.

[19] W. F. McFee and R. R. Baldridge: "Physiological Considerations Related to the Infusion Treatment of Shock", *Annals of Surgery*, Volume c, 1934, page 266.

THERAPY BY RADIUM AND X RAYS.

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The discoveries of radium and X rays were made approximately forty years ago. It was in 1898 that the Curies published the paper in which they described the new element radium. In 1905 many papers had been published on the biological and therapeutic effects. As a result of work done in this period, Tribondeau and Bergonié[1] formulated the law which is known by their names. It has remained the most widely accepted statement on this problem. Other factors influencing the effect of radiation have been investigated and proven, but most users of these agents refer back to the "law" which states "that the more active the mitosis and the less differentiated the tissue, the more sensitive will it be" to this type of radiation.

This statement is supported and supplemented by the conclusion reached from the experiments of Vintemberger[2] and Mottram,[3] that the period of mitosis is that of greatest sensitivity. The latter author[4] has also demonstrated a greater vulnerability of the nuclear material than of the protoplasmic material. Other investigators,[5][6] however, report experiments which suggest that it does not matter at what stage of mitosis the radiation is applied. This may be consistent with the report of Spear[7] and of Mottram *et alii*,[8] that the result may be achieved by preventing the cell entering the next mitotic division or by failure to divide several generations later. While Regaud and Blanc[9] agree that mitosis is very important, they point out that there is an individual sensitivity for each type of cell. Desjardin[10] has reviewed this subject, and appears to be of the opinion that many tumours have a sensitivity corresponding to that of the parent cell. This sensitivity will be modified also by the rate of mitosis.

In addition to these factors of mitosis and inherent qualities, several experimenters have found that increased metabolism of the cell increases the sensitivity of the tissues. These observations have been collected and correlated by Sittenfield.[11] This conclusion fits well with an observation of Mottram and Eidinow, that anæmia increases the resistance of tissues to the action of radiation. Packard[12] also noted that increase of temperature of the medium in which cells are growing increases the sensitivity of the cells. Cramer and Crabtree,[13] however, found that cyanide increases the sensitivity of tumours to radiation.

Another factor which has been investigated with more enthusiasm than circumspection, is that called the indirect effect of radiation. This vague term has covered the following four main hypotheses:

1. Ehrlich and subsequent observers postulated that a toxic substance is produced by the action of the radiation. This substance then acts on the cells. Though one cannot escape the conclusion that γ and X rays produce some alteration of the chemical or physico-chemical state in the cell, especially in the nucleus, no definite evidence of an intermediate noxious agent has been adduced. It has been proved that large doses of these agents produce alteration in body proteins.[14][15] I have found, however, that doses of γ rays, exactly comparable with the highest therapeutic dose, have no denaturing effect on egg albumen or globulin, serum albumin or globulin or hæmoglobin.

2. It was considered possible that the local tumour, while regressing, immunized the animal and caused regression of those neoplasms not subjected to radiation. Though Lumsden has shown some immunity effects in laboratory animals with transplanted tumours, no effect has been demonstrated in animals bearing a primary tumour.

3. The third hypothesis concerns the indirect effect on the tumour produced by the altered condition of the connective tissue of the stroma. Apparently this hypothesis received its greatest impetus from the reports of Exner,[16] that a proliferation of connective tissue preceded any demonstrable change in the parenchyma of carcinomata. This has not been confirmed by subsequent observers.[17] There is no doubt that radiation does affect connective tissue; this change will be considered later. At this point the question is whether or not irradiated fibrous tissue is or is not a satisfactory medium for the growth of neoplasms. Russ and Scott[18] have carried out experiments which prove that tumour tissue will grow in it, but not so well as in normal tissue. Lacassagne also has demonstrated that essentially it is radiation of the tumour tissue, not of the connective tissue, which produces the result. The experiments of Cramer,[19] though apparently proving his contention that the indirect effect is most important, prove only that neoplastic tissue in the metabolic conditions existing when it is cut off from its blood supply is less sensitive than when this is intact.

The discussions of experiments, which usually are quoted as showing that the resolution of epithelial tissue is due to overgrowth of fibrous tissue, overlook the relationship existing between these two tissues. Continued change of epithelial arrangement and activity is always associated with a rearrangement of the fibrous and vascular tissue. An example from normal physiological change is those changes which occur in the breast tissue at lactation and regression. In this case the site of primary stimulation by the hormones is the epithelium; the fibro-vascular reaction is local in the breast only, not general throughout the whole body. A fair conclusion is that this response of the nutritive tissues is a local response to the epithelial change. In considering the response which takes place after irradiation of a carcinoma, one must, therefore, consider

two factors: first, the direct effect of the radiation on the fibro-vascular tissue, and, secondly, the reaction of the fibro-vascular tissue to the alteration in differentiation and activity excited in the epithelial tissue by the irradiation.

Statements that the increased amount of fibrous tissue with a greater amount than usual of collagen causes pressure necrosis of the carcinoma cells are negatived by the observations of Russ and Scott[18] and Lacassagne, that carcinomatous tissue will grow in irradiated tissues. The conception that the residual carcinoma cells are held confined by the connective tissue has its origin in the "battle hypothesis", a tacit assumption of which is that the fibro-vascular tissue can readily recognize a noxious agent. One might just as logically postulate that

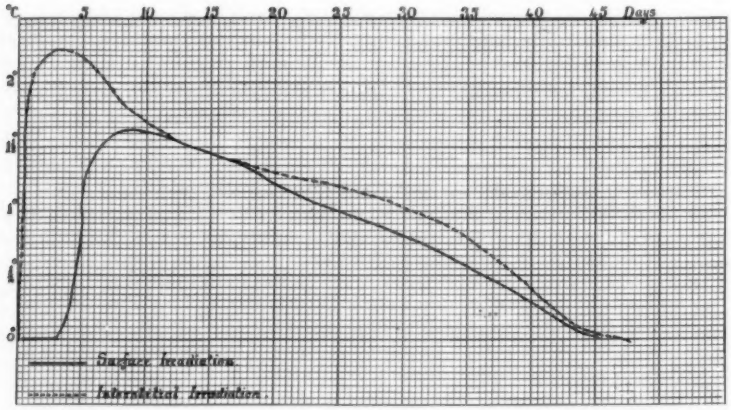

FIGURE I. The increase of surface temperature of the irradiated area is shown over a period of six weeks. It is evident that there is an increased flow of blood per unit time and area. No initial decrease is evident either when the surface or interstitial radiation is used.

the epithelium of the breast at the climacteric is a noxious agent and so excites a defensive fibrosis. In this case all recognize that the breast is a new type of organ with altered tissue relationships. A tumour which has not been sterilized completely by irradiation, but in which quiescence has been obtained, is a new tumour of a very curious type. The relations between its stroma and neoplastic tissue have been greatly altered. That surgical interference with this tumour often will excite renewed activity does not imply that the connective tissue was confining the neoplastic tissue.

4. Since the earliest observations on the effects of γ and X rays it has been believed that a common effect of these agents is thrombosis and obliteration of blood and lymphatic vessels. More recently Pullinger[20] has produced evidence that much of the effect of radiation

on tissues and tumours is due to thrombosis of vessels. The whole argument is based on microscopic observation of fixed tissues. No evidence is given as to whether the material described as blood clot contained fibrin. I have, therefore, used a physiological method to determine whether the blood flow per unit of time through skin which has been irradiated is or is not reduced. Before irradiation the relation between the surface temperature of the skin near the lesion and that on the opposite point on the patient was determined. Provided the patient was allowed to stay ten minutes in a draughtless atmosphere and the tumour was not inflamed, these invariably were equal. Ten patients were irradiated by plaque and ten by interstitially placed radium. The surface temperature of the part was followed for at least five weeks. In Figure I are shown typical results. In those irradiated interstitially the temperature was raised on the following day, and then showed elevation for as long as five weeks. In those irradiated by surface plaque the temperature did not rise until the third or fourth day, after which it followed much the same general curve as that of the cases in which needling was used. No fall of surface temperature occurred in this initial period. One may conclude that in the case of interstitial irradiation the early hyperæmia is due to the trauma of implantation, and that when surface irradiation is employed no demonstrable decrease in total blood flow occurs in the initial period, and that the hyperæmia which develops after the first six days follows the same course, no matter by what method the irradiation is administered. Vascular blockage must then play a very small part in causing regression of tumours after irradiation.

HISTOLOGICAL RESULT IN NEOPLASMS.

The histological result of irradiation of the several types of neoplasms will be described.

Epithelial Tumours.

Basal Celled Tumours.—Basal celled tumours of the following type were irradiated: rodent ulcer, basal celled carcinoma of *cervix uteri*. The result in these tumours is that of lysis of the nucleus and protoplasm, leading to what might be termed a fading away of the tumour cells. Associated with this phenomenon, there are hyalinization of the stroma and some obliteration of blood vessels. Slight leucocytic and lymphocytic reaction also occurs.[21]

Prickle Celled Tumours.—Some days after irradiation of prickle celled tumours of the tongue, skin or *cervix uteri* by γ rays, the nucleus shows alteration of chromatin with final nucleolysis. The protoplasm becomes clear and hyaline (Figures II and III). Finally there are left in the place of the tumour tissue, nests of non-nucleated keratin (Figure IV), which are often surrounded by foreign body type of giant cells. Eosinophilic polymorphonuclear leucocytes are frequently found in the regressive stages. Overgrowth of the stroma and decrease of vascularity

complete the changes. This may occur around nerves, leading to perineuritis (Figure V). Muscle tissue may show varying grades of damage and marked sarcolemmal proliferation may be present, even two years after irradiation (Figure VI).

Columnar Carcinoma.—As a result of irradiation of columnar carcinoma of the breast or bowel there is a swelling of the nucleus and protoplasm. In some cases this is followed by a complete lysis of the

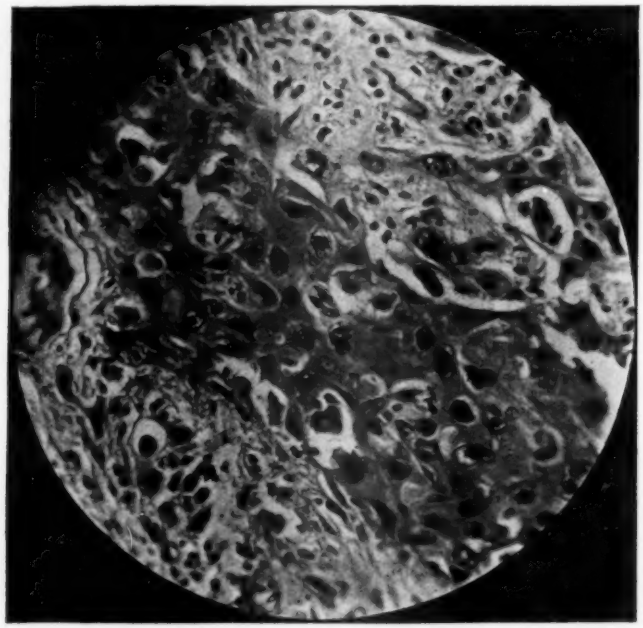

FIGURE II. Photomicrograph—hæmatoxylin and eosin—× 400. Section of epithelioma before irradiation.

whole cell. In other cases the cells become arranged as a low columnar epithelium around acini into which a mucous or clear fluid secretion occurs. The overgrowth of stroma with slight leucocytic infiltration occurs here also, and when the condition is in bone this new stroma may take the form of bone.

Lymph Tissue Tumours.

Hodgkin's Disease.—After irradiation in Hodgkin's disease there develops over the course of several weeks a type of tissue which shows large areas of hyaline connective tissue, with occasional oval, dark

nuclei scattered through it (Figure VII). Associated with this change there is usually, especially in the glands first irradiated, a marked reduction in size of the glands.

Lymphosarcoma.—Lymphosarcomatous tissues show an extremely rapid retrogression of size of the glands, with a "fading away" of the tissue elements.[22] A very rapid response may be obtained also with local benign lymphomata.

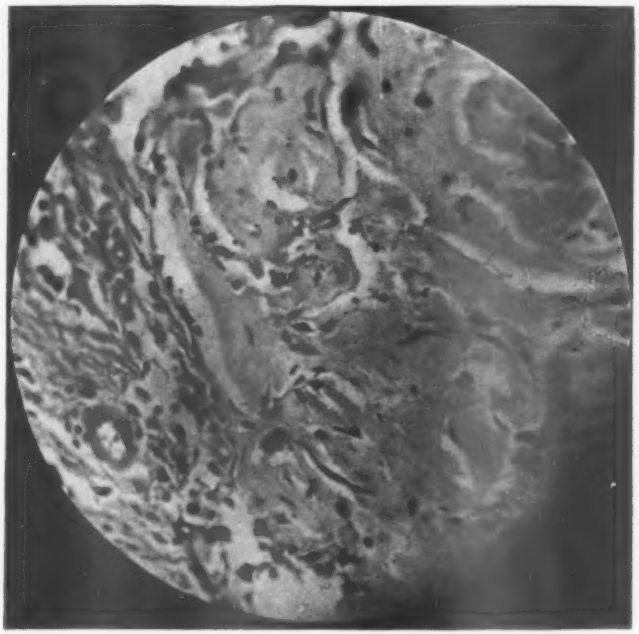

FIGURE III. Photomicrograph—hæmatoxylin and eosin—× 400. Specimen of epithelioma from same case as Figure II fourteen days after irradiation for six days by 1·5 millicuries of radon per centimetre, screened by 0·8 millimetre of gold. This field was close to the site of a needle puncture. All nuclear material has disappeared, and the protoplasm is represented by masses of hyaline material having the appearance of imperfectly formed keratin.

Lymphatic Leuchæmia.—The glands in lymphatic leuchæmia are commonly resistant to radiation.

Lympho-Epithelioma.—Lympho-epithelioma frequently gives a reaction almost as dramatic as that in lymphosarcoma, with complete local retrogression of the lesion.

Hæmopoietic Tissue Tumours.

Small doses of radiation to the normal subject may give rise to an increase in number of polymorphonuclear cells in the blood stream. The essential effect on the bone marrow and other hæmopoietic tissues in cases of abnormal blood genesis is depression of activity, even to the stage of anaplastic anæmia. This must be guarded against in cases of myeloid leuchæmia and Hodgkin's disease.

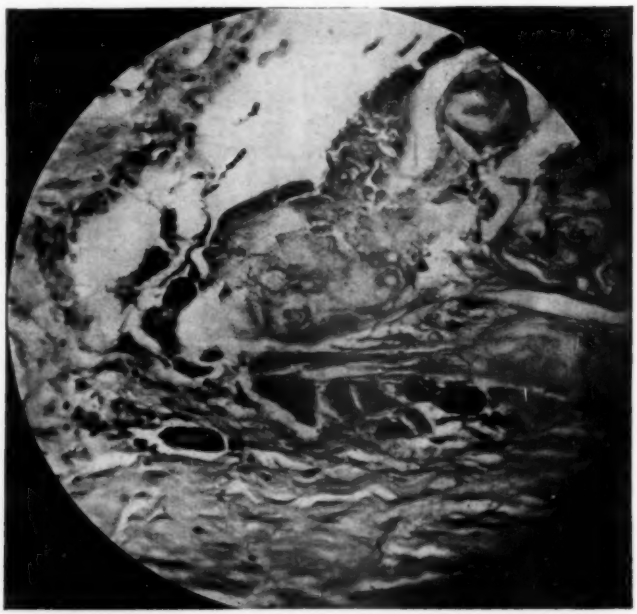

FIGURE IV. Photomicrograph—hæmatoxylin and eosin—x 300. Section of tongue in which a carcinoma was irradiated by interstitial needles fifteen months previously. Masses of keratin surrounded by foreign body giant cells are all that remain of the neoplasm.

Connective Tissue.

In the group of connective tissue tumours we include those known as fibrosarcoma, perineural fibrosarcoma, myxoma, chondrosarcoma and osteosarcoma. Though some cases respond to the irradiation by increased maturity of the tissue, many show no apparent response.

Unclassified Bone Tumours.

Ewing's Tumour.—Irradiation of Ewing's tumour usually leads to complete resolution of the first or even several of the lesions. In one

case with a lesion in the radius, in which amputation was performed eight weeks after irradiation, no neoplastic tissue was found. Usually the lesion becomes too widespread for effective treatment.

Benign Giant Cell Tumour.—In somewhat over 50% of benign giant cell tumour (myeloid sarcoma, myeloma) irradiation leads to maturation with ossification of the spindle celled stroma of the tumour. The final picture is one of reduction of total size of the tumour, with irregular

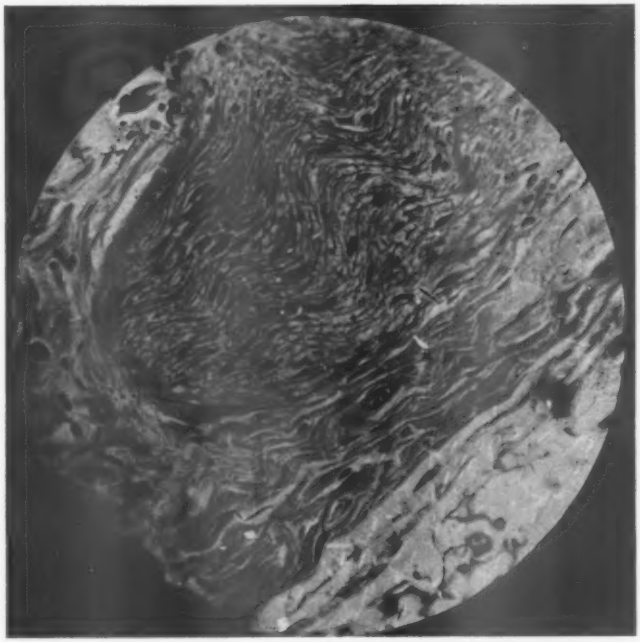

FIGURE V. Photomicrograph—hæmatoxylin and eosin—x 400. Epidermoid carcinoma of tongue treated by radium two years before. Excision of tongue performed because of intractable pain and benign papillomata of dorsum. Marked perineural proliferation of connective tissue present.

heavy bone trabeculation lying in firm hyaline fibrous tissue. In the other cases the lesion progresses, even while radiation is progressing. Some of these eventually prove to be malignant giant cell tumours.

Nervous Tissue.

Gliomata.—Carmichael and Ross[23] have shown that generally nervous tissue is less sensitive to radiation than are the vessels and fibrous

tissue of the cerebrum. This is reflected in the behaviour of tumours of the glioma group to irradiation. Here, in the majority of cases, massive degeneration rather than cytolysis occurs in those cases which show any response. The vulnerability of the scalp usually precludes the use of a dose sufficient to produce this effect.

Medulloblastoma.—Medulloblastomata are separated from the glioma group because a partial resolution of the tumour may occur as a result of irradiation, but permanent quiescence is unusual.

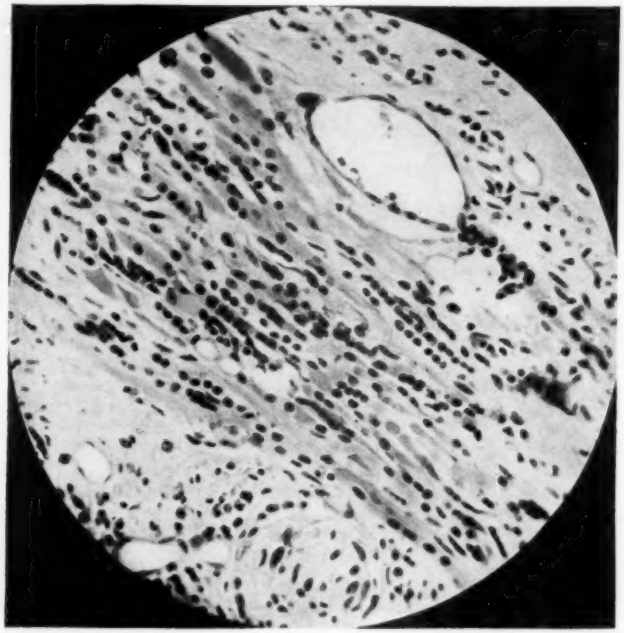

FIGURE VI. Photomicrograph—hæmatoxylin and eosin—× 400. From same specimen as Figure V. Degeneration of muscle and sarcolemmal proliferation are evident.

Melanoma.—Masson's view of the origin of melanoma is here accepted because its radiosensitivity corresponds more closely to that of nervous tissue than to that of any other tumour of epidermal origin. Some specimens show response to radiation. One specimen excised two years after irradiation showed only a blackened scar in place of a fungating mass. The cells at the original biopsy were large and hyperplastic, those of the scar showed pyknotic nuclei, no evident protoplasm and an arrangement corresponding to that of a benign melanoma. On the other

hand, one may find a melanoma continue to grow rapidly in the centre of the defect from which the surrounding tissues have sloughed as a result of excessive dosage. The blood supply of the tumour remains intact.

Muscular Tissue.—I have had no specimens of leiomyosarcoma for examination. A specimen of rhabdomyosarcoma irradiated six weeks

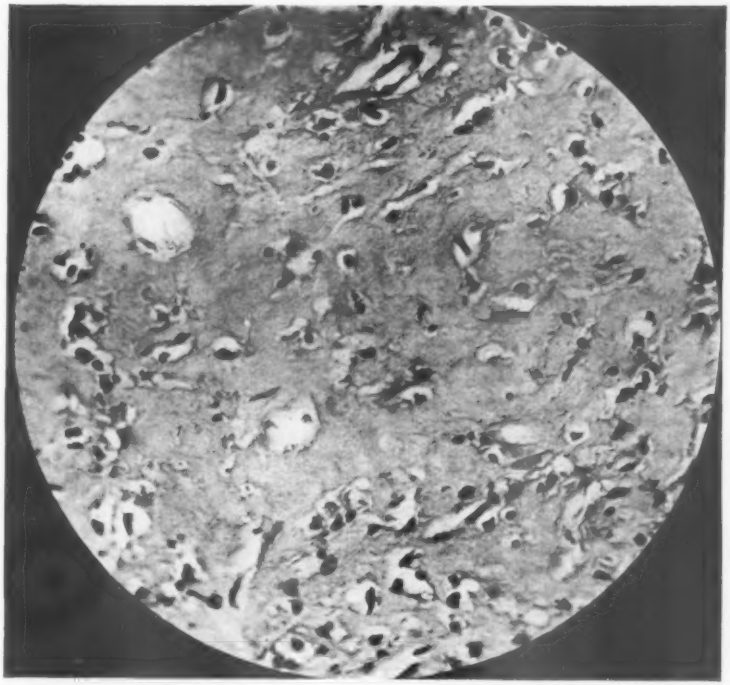

FIGURE VII. Photomicrograph—hæmatoxylin and eosin—× 300. Specimen of cervical lymph glands irradiated for Hodgkin's disease three months before death. The mass reduced from two inches to less than a quarter of an inch in diameter. The cellular mass has become almost acellular.

before removal showed slight necrosis at the centre of a tumour 7·5 centimetres (three inches) in diameter. The peripheral part of the tumour showed excellent microscopic detail, and no evidence of degeneration of the tumour cells could be found. The fibrous tissue which was plentiful between these cells, showed well-marked collagen formation. That the tumour recurred three months after removal suggests that irradiation has a very slight action on this type of tumour.

In such conditions as endometrial hyperplasia and keloid it is presumed that a result similar to that occurring in the malignant conditions is produced.

In hyperthyreoidism and pituitary basophilism regression of epithelial tissue both in structure and function may occur.

RESULTS OBTAINED.

A general review of the histological modification developing in a lesion has been given. More interest attaches to the cure rate in these various conditions. Reference must be made to such publications as the annual reports of the National Radium Commission of Great Britain[24] and the paper of Pfahler[25] on irradiation of breast tumours.

From the results here recorded it is evident that there are three main aims in therapeutic use of the radiations under discussion. In many cases in which the tumour is sensitive, the site is accessible and the general condition of the patient is satisfactory, a cure may be obtained. In those cases in which pain is a prominent feature or surface ulceration is offensive, but in which the metastases are too widespread to allow cure, when the tumour is sensitive, considerable palliation may occur. Finally, it is apparent from the published results that it may serve another useful purpose. In the border-line and inoperable cases of carcinoma of the breast the results show that if the tumour is first irradiated and then excised, the patient has a definitely better prognosis than if either agent is used exclusively. The relation of the cervical glands to the carotid sheath probably in many cases precludes such a procedure in this region.

LEGACY OF IRRADIATION.

Apart from the question of residual resistant tumour, it must be realized that often, even when apparently complete resolution of the tumour occurs, the area has not been sterilized of neoplastic tissue, but that, as previously suggested, a new form of tumour is present. The practical importance of this conception is that this area must be treated with the same caution as the original tumour. Surgical disturbance, short of wide excision, of such an area may have the same consequences as incomplete excision of the original tumour.

The other important point is to realize that the tissues of the area—epithelial, fibrous, vascular, muscular and bone—are also different from normal tissues. In a previous paper[26] I have dealt with the alteration in these tissues. Later[27] it was proven that these tissues are less than ordinarily resistant to noxious agents and less than ordinarily capable of what usually are termed reparative processes. All these features must be realized by those undertaking any procedure which interferes with such areas, even though they may be far from any pre-existing neoplasm.

CONCLUSIONS.

Evidence from observations and literature is adduced which suggests that:

1. The effect of radiation by X and γ rays may produce immediate death, followed by lysis of the cells of neoplastic tissues. A degree of change in which a permanently altered potentiality of differentiation and reproduction is engendered in the tissues, may be considered to result from a lesser effect of these radiations.

2. The permanent change in the tissues of the neoplasm is associated with an alteration of the fibro-vascular stroma of carcinomata and the vasculature of connective tissue tumours.

3. To this physiological reaction of the fibro-vascular tissues is added the mutation of these tissues in response to direct radiation. This change makes these tissues a less satisfactory field for recurrent growth of neoplasm, and much more vulnerable to injury and less capable of repair than are normal tissues.

REFERENCES.

(1) J. Bergonié and L. Tribondeau: "*Action des rayons X sur le testicule du rat blanc (troisième note)*", *Comptes rendus des séances de la société de biologie*, Volume xcviii, 1905, page 154; "*Action des rayons X sur le testicule du rat blanc (quatrième note)*", *ibidem*, p. 155; "*Aspermatogenèse expérimentale après une seule exposition aux rayons X*", *ibidem*, page 282; "*L'aspermatogenèse expérimentale complète obtenue par les rayons X. Est-elle definitive?*", *ibidem*, page 678; "*Lésions du testicule obtenues avec des doses croissantes de rayons X. Comment se produisent'elles?*", *ibidem*, page 1029; "*Interprétation de quelques résultats de la radiothérapie et essai de fixation d'une technique rationelle*", *Comptes rendus des séances de l'academie des sciences*, Volume cxliii, 1906, page 983.

(2) P. Vintemberger: "*Sur les variations de la radio-sensitivité au cours des premières mitoses de segmentation dans l'œuf de Rana fusca*", *Comptes rendus des séances de la société de biologie*, Volume xcviii, 1928, page 532.

(3) J. C. Mottram: "On the Action of X and γ Rays of Ra on the Cells in Different States of Nuclear Division", *Archives of Middlesex Hospital*, Volume xxx, 1913, page 89.

(4) J. C. Mottram: "Chromatic Inclusions in the Cytoplasm of Cells after γ Radiation, and Changes in the Nucleolus", *Journal of the Royal Microscopical Society*, March, 1933, Series iii, Volume liii, Part 1.

(5) P. Ancel and P. Vintemberger: "*Sur la radiosensibilité des cellules dans caryocinèse*", *Comptes rendus des séances de la société de biologie*, Volume xcii, 1925, page 986.

(6) R. Cattley: "Cytological Changes Produced by the Action of X-Rays on the Growing Root Tips of Plants", *Journal of Pathology and Bacteriology*, Volume xiii, 1909, page 380.

(7) F. G. Spear: "The Delayed Lethal Effect of Radium on Tissue Cultures in Vitro", *Proceedings of the Royal Society*, Series B, 1930, Volume cvi, page 44; *ibidem*, 1931, Volume cviii, page 190.

(8) J. C. Mottram, G. M. Scott and S. Russ: "On the Effects of γ Rays from Radium upon the Division and Growth of Cancer Cells", *Proceedings of the Royal Society*, Series B, Volume c, 1926, page 327.

(9) C. Regaud and J. Blanc: "*Effets généraux produits par les rayons de Röntgen sur les cellules vivantes d'après les résultats observés jusqu'à présent dans l'épithélium séminal*", *Comptes rendus des séances de la société de biologie*, Volume lxi, 1906, page 731.

(10) A. U. Desjardin: "Radiosensitiveness of Cells and Tissues and Some Medical Implications", *Archives of Surgery*, Volume xxv, 1932, page 927.

(11) M. J. Sittenfield: "Radiosensitiveness of Malignant Tissue and its Biologic Significance", *American Journal of Roentgenology*, Volume xix, 1928, page 150.

(12) Charles Packard: "The Susceptibility of Cells to Radium Radiation", *Proceedings of the Society for Experimental Biology and Medicine*, Volume xx, 1922, page 226.

(13) H. G. Crabtree and W. Cramer: "Action of Radium on Cancer Cells. I. Effect of Hydrocyanic Acid and Sodium Fluoride on Metabolism and Transplantability of Cancer Cells", *Proceedings of the Royal Society*, Series B, 1933, Volume cxiii, page 226; "II. Some Factors Determining the Susceptibility of Cancer Cells to Radium", *ibidem*, page 239.

(14) A. Fernau and Adolf M. Spiegel: "*Physikalisch-chemische Untersuchungen bestrahlter Proteine. V. Mitteilung. Die Veränderung des Seralbumins bei Einwirkung durchdringen der Radiumstrahlung und ihre Beziehungen zur Hitze und Lichtgerinnung*", *Biochemische Zeitschrift*, Volume cciv, 1929, page 14.

(15) J. Loiseleur and A. Urbain: "*Sur les propriétés antigéniques du collogène et leur modification sous l'action de l'émanation du radium*", *Comptes rendus des séances de la société de biologie*, Volume ciii, 1930, page 776.

(16) Exner: Quoted by Alter, *loco citato*.

(17) N. M. Alter: "Histological Changes of the Different Types of Carcinoma after Exposure to Radium Rays", *Journal of Medical Research*, Volume xl, 1919, page 241.

(18) S. Russ and G. M. Scott: "The Growth of Tumours in Tissues Exposed to X-Rays and Radium", *The Lancet*, Volume i, 1927, page 815.

(19) W. Cramer: "Experimental Observations on the Therapeutic Action of Radium", British Imperial Cancer Research Fund, Tenth Report, 1932, page 95.

(20) B. Pullinger: "Causes of Cell Death in Irradiated Tumour Tissue", *Journal of Pathology and Bacteriology*, Volume xxxv, 1932, page 527.

(21) N. M. Alter: "Histological Changes of the Different Types of Carcinoma after Exposure to Radium Rays", *Journal of Medical Research*, Volume xli, 1920, page 439.

(22) Wm. Stone and L. Graver: "The Biological Effects of the X-Ray and Radium as an Aid in the Diagnosis of Neoplastic Diseases", *Annals of Surgery*, Volume lxxxix, 1929, page 176.

(23) E. A. Carmichael and J. Ross: "Radium and Nervous Tissue. An Experimental Study", *Proceedings of the Royal Society of Medicine*, Section of Neurology, Volume xxiii, 1930.

(24) Appendix to the Fifth Annual Report of British Radium Commission.

(25) G. Pfahler and J. Vastine: "Technique and Results of Irradiation in Carcinoma of the Breast", *American Journal of Roentgenology*, Volume xxxiii, 1935, page 41.

(26) R. D. Wright: "Pathological Manifestations in Radionecrosis", *The Medical Journal of Australia*, Volume ii, 1934, page 8.

(27) R. D. Wright: "The Modification of the Biological Effects of Radon by Alteration of Screenage", *American Journal of Roentgenology*, November, 1936.

SIDELIGHTS ON DISEASE OF THE PROSTATE GLAND.[1]

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THE prostate is a complex structure consisting of tubular glands with connective tissue and unstriped muscle fibres, situated at the neck of the bladder at the junction of the genital and urinary systems. As well as the true prostatic glands, there are in the region of the bladder neck groups of submucous glands placed under the trigone and around the prostatic urethra. These glands arise developmentally as buds from the urogenital sinus, appearing first in the 55 millimetre embryo. The prostate attains its normal size at puberty, thanks to the secretion of the interstitial cells of Leydig. With the onset of activity of the germinal epithelium, the development of the prostate ceases, and the normal gland remains stationary in size until the sixth decade, when, as the result of testicular atrophy, the secretion of the germinal epithelium, known as the male hormone, lessens.(1) The male hormone regulates the development, preservation and functions of the prostate. The prostate is also under the control of the basophile cells of the anterior pituitary, as well as of the female follicular hormone, which is present in the testes and the urine. In old age, with atrophy of the germinal epithelium, the male hormone secretion lessens by half. At this stage the pituitary endocrine centre seeks the aid of prolan to reestablish the function of the genital glands. This prolan promotes the formation of prostatic adenoma. The increased prolan secretion begins as soon as it is no longer inhibited by germinal epithelium secretion. It continues until the basophile cells are exhausted and replaced by eosinophile cells. The female follicular hormone controls in the male the plain muscle of the prostate, seminal vesicles and *vasa deferentia,* together with the connective tissue of the ampullæ, pavement epithelium of the prostate and efferent ducts of the seminal vesicles; it stimulates the growth and development of the generative system, together with the male hormone, and its action is balanced by that of the male hormone. With advancing years, as the secretion of the male hormone diminishes, the secretion from the cells of Leydig being no longer inhibited to the same extent, the prostate enlarges. At the same time, prolan is increased in the blood and further stimulates the cells of Leydig; and, as the female hormone secretion is maintained, there is yet another stimulus to prostatic

[1] Abridged from an address delivered to the Otago Division of the New Zealand Branch of the British Medical Association at Dunedin, August, 1936.

growth. According to this theory, and its accuracy is disputed, any procedure which will maintain the balance between these various hormones will prevent the onset of prostatic hypertrophy, hyperplasia or adenoma. It is claimed by Niehans that interepididymo-testicular ligature is the best means we have at present of securing this result, and by February, 1936, he had persuaded nearly 400 patients to undergo this operation, a minor procedure, and a harmless experiment in preventive surgery, provided the subjects are investigated thoroughly, kept under careful observation and more orthodox procedures carried out as required. Elliot-Smith reports his results on twenty cases.[2] Niehans believes that, as the result of a properly placed ligature, the testicular hormones pass through the pores of the *tunica albuginea,* and so reach the veins surrounding the testis; others are of opinion that the beneficial results are due to action on the sympathetic system, there being a ganglion at the site of the ligature. Others, notably Lower, Engel and McCullagh,[3] have obtained good results in benign prostatic hypertrophy by feeding with whole desiccated testicular substances. Others, Deming, Jenkins and Van Wagenen,[4] believe that "there is no pathological or histological evidence that the action produced by castration or any hormone influences the growth of prostatic hypertrophy". However, my own observations and the weight of clinical evidence are against this.

The great danger of prostatic hypertrophy is the obstruction it causes to the urinary outflow at the bladder neck, with its consequent ill-effects on the bladder, ureters and kidneys. Apart from adenoma formation there is one other main pathological process which causes bladder neck obstruction, and that is fibrosis. Fibrosis appears in many cases to be the end result of infection, and so, with further enlightenment on the treatment of that common condition, prostatitis, a diminution in the numbers of obstructions due to this cause can be expected.

Briefly, then, bladder neck obstruction may be caused by hypertrophy of true prostatic glands, or of subtrigonal, subcervical or submucous urethral glands, or by a fibrosis in the region of the prostate, bladder meatus or trigone, or in some cases by a mixture of hypertrophy of glands and a fibrosis. The ultimate result of these changes is an alteration in the relation of the internal urethral meatus to the rest of the bladder, with incomplete emptying of the viscus, residual urine and often infection.

Before the treatment of these conditions is attempted it is absolutely necessary for the welfare of the patient that an accurate diagnosis of the lesion should be made, and that the amount of damage that the body as a whole has suffered should be gauged; this is done by means of a general clinical examination and a thorough urological investigation. It is not my intention to go into the details of these procedures, but the general examination should exclude the presence of syphilis, tabes or other central nervous system disease, which may cause atony of the bladder and so mimic prostatic obstruction, or the pseudo-prostatism

of chronic nephritis. On the other hand, there is a group of conditions consisting of infections of the gland which demand treatment entirely different from that of the so-called senile prostatic disease. These are as follow:

1. *Congestive Prostatitis.*—The subject of congestive prostatitis complains of a feeling of general irritability, of a fullness or weight in the perineum, sometimes of frequency of micturition, sometimes of sacral backache. The gland is enlarged and tender. Many cases are caused by sexual excesses, by sudden cessation of regular intercourse, by excitation without gratification, by indulgence in rich foods and alcoholic excess. The condition is relieved by massage, regulated coitus, attention to diet and moderation with alcohol. Some patients are greatly benefited by prostatic diathermy at five-day intervals. The condition is due to retained prostatic secretion, and it has been suggested that this is toxic to the male.[5] Such patients have either no residual urine, or less than two ounces, and so do not require operative measures.

2. *Mild Infective Prostatitis.*—The cause of a mild infective prostatis is often difficult to ascertain. It is frequently the end result of gonorrhœa, the original organisms being replaced by staphylococci, enterococci or diphtheroids; in other cases it is due to blood-borne infections originating in gums, tonsils, sinuses or intestinal tract. In addition to local treatment to the gland itself, it is imperative in this class of case to eradicate whatever foci of apparent infection are present in other parts of the body. Even if these foci are not the cause of the prostatitis, yet their presence in the body lowers its resistance and retards the ultimate cure of the prostatic trouble.

3. *Gonorrhœal Prostatitis.*—Under the heading of gonorrhœal prostatitis, vesiculitis must be included, for the vesicles, being more difficult of access to the finger, do not receive as much attention as does the prostate. Also, having a poorer blood supply, they do not have the same chance of throwing off the infection. To many what appears to be a chronic prostatic infection is in reality vesicular. The chronicity of many infections is due to a lack of appreciation of this fact, with consequent inadequate treatment. Massage, instrumentation, irrigations, instillations, vaccines, intraprostatic injections and chemotherapy all play their parts in the treatment of prostatitis, while, in addition, vasotomy may be necessary to clear up a vesiculitis.

4. *Non-Gonorrhœal Prostatitis.*—Non-gonorrhœal prostatitis is due to infections from the urethra by instrumentation, faulty irrigations and injuries from too forcible massage. The prostate may be infected secondarily to a pyelitis or a non-specific urethritis.

5. *Prostatic Calculi.*—True prostatic calculi are formed within the acini. They are due to obstruction aided often by infection, and arise from the *corpora amylacea*. Sometimes they are palpable, giving rise to a feeling of crepitus. In many cases they are symptomless, but may give rise to the ordinary signs of prostatitis, occasionally to obstruction.

The best way to secure radiological evidence of calculi is to have the pelvis tilted so that the shadows are thrown clear of the *symphysis pubis*.

6. *Tuberculosis of the Prostate.*—It is very rare to find only the prostate affected in tuberculosis, other lesions being almost invariably present in the vesicles, epididymes or kidneys. As an aid to diagnosis the prostatic fluid may be examined for tubercle bacilli or injected into a guinea-pig. A most important point in the treatment of this condition is that the necessity for sanatorium life or its equivalent is as great as in pulmonary tuberculosis.

7. *Prostatic Abscess.*—If a prostatic abscess is acute, it is accompanied by a fair degree of fever; often it follows an acute prostatitis, but may arise as a hæmatogenous infection, or complicate an adenoma. This condition is relatively uncommon. Some abscesses rupture spontaneously into the urethra; others may be treated successfully by aspiration, or by opening them intraurethrally with the endotherm knife, but if they are of any great size they are better drained perineally.

In the diagnosis of all forms of prostatitis massage combined with the microscopic study of the secretion plays a most important part. Normal prostatic fluid consists of lecithin bodies, *corpora amylacea*, prostatic granular cells and perhaps an occasional leucocyte. If leucocytes appear, this is presumptive evidence of an infection. If the leucocytes are clumped, the naked-eye specimen shows shreds, most easily distinguished by adding water to the vessel in which the fluid has been collected. Shreds of coagulated normal prostatic fluid may result from a congested poorly draining gland. Microscopic examination establishes the diagnosis. A granular appearance with absence of lecithin bodies betokens an infection, subsequent massage often being productive of numerous leucocytes. A prostatitis cannot be regarded as cured until the prostatic fluid becomes normal; and if, after an attack of gonorrhœa, leucocytes persist in the films of the fluid, no guarantee of cure of the infection can be given. At this stage urethroscopy is invaluable in diagnosis and treatment. After an attack of gonorrhœa three films of prostatic fluid examined at intervals of a week should be found to be normal before it can be said that the prostate itself is free from infection; and in some cases it can be shown urethroscopically, especially when small cysts persist, that this is no absolute guarantee. The persistence of leucocytes in the films is evidence of infection from some cause, and this may be responsible for the appearance of such complications as iritis, arthritis, fibrositis or so-called neurasthenia.

Another very valuable, and I fear somewhat neglected, aid to diagnosis in all bladder neck conditions is cysto-urethroscopy; and with few exceptions it should be resorted to before treatment is instituted when there is doubt as to the exact diagnosis. Of course, when one is dealing with a large soft adenomatous prostate bulging into the rectum and lengthening the urethra considerably, as well as angulating it acutely, then instrumentation will do more harm than good. In

tuberculosis it is necessary to proceed with care; but in all obstructions of the fibrous type, especially when resection is indicated, it is well to investigate the state of the prostatic urethra and bladder before planning the course of treatment. In chronic prostatitis and vesiculitis the urethroscope is invaluable. The condition of the prostatic urethra, the *veru montanum*, the orifices of the ejaculatory ducts, the orifices of the prostatic ducts, median and interureteric bars, bladder trabeculation, diverticula, calculi, a post-trigonal recess, all can be studied. In uncured gonorrhœa, prostatic cysts, abscesses, sinuses may be seen. Shreds hanging out of the ejaculatory ducts or from those opening into the prostatic fossette, are indicative of a vesiculitis or a prostatitis. Polypi on the *veru montanum* may be the cause of premature ejaculation, of post-gonorrhœal neurasthenia, or, if of nothing else, then of the worrying persistence of urinary shreds. Actually what part of the prostate is causing the obstruction, whether it is a contracture, a subvesical as opposed to an intravesical enlargement, the amount of bulging of the lateral lobes, these and other relevant facts, including the scope of the operation, can all be estimated beforehand. If cysto-urethroscopy was used much more in prostatic disease there would be fewer failures and disappointments; it is just as rational a procedure as it is "to look before you leap", and the man who treats prostatic conditions without urethroscopic aid is in the same class as the one who treats fractures without the use of X rays.

My reason for stressing the importance of examining the prostatic secretion and of urethroscopy in prostatic disease is that these measures are too often neglected. It would appear that many of the bad results from resection are due to inexperienced operators selecting unsuitable cases. After all, one cannot expect to cure a chronic gonorrhœal prostatitis by slicing a bit out of the bladder neck. What happens is that a more or less healthy piece of mucosa is replaced by a raw area which becomes infected, or perhaps prostatic ducts which were draining become sealed up by the cauterizing action of the endotherm knife. In any case, until the appropriate treatment is instituted little benefit can be expected.

Before any procedure for removal of bladder neck obstruction is undertaken it is essential to examine thoroughly the urine, the external genitals, the abdomen, kidney function; and it is advisable to examine the urinary tract with X rays for the presence of calculi. Once the type of bladder neck obstruction has been diagnosed, then the operative treatment can be planned. For the large soft adenoma which shells out easily and quickly, enucleation is the operation of choice. My own preference is for the Thomson Walker procedure. It gives a good exposure of the cavity, permitting one to trim up the tags and control the hæmorrhage, while the technique is not difficult to acquire. It appeals to me as the safest procedure for the surgeon who does an occasional prostatectomy, whereas perfection in the Harris operation or in perineal prostatectomy requires a good deal of experience with

these special methods. Because Harris and Young publish good statistics, it does not follow that their operations should be the choice of the general surgeon. It is an indication of their wise choice of patient for operation, and of their surgical skill. When the gland cannot be enucleated easily, it is possible to remove it by a combination of dissection with knife and scissors; and when the diagnosis has been in error and a small fibrous prostate or bar is encountered unexpectedly, one can with the Thomson Walker exposure remove a wedge from the bladder neck posteriorly under direct vision.

Under the heading of resection one includes those intraurethral instrumental methods of removing part or all of the tissue causing the obstruction. The choice here lies mainly between the cautery punch, the Colling's electrotome, and the resectoscope, with their various modifications. Most methods in properly selected cases give good results. What counts is the skill, experience and personal predilection of the operator. The punch removes larger pieces of tissue than the loop of the resectoscope; but there is the difficulty of gauging exactly the right amount of coagulation in each case with the punch, whereas with the resectoscope this can be regulated visually. Through the resectoscope the operator can see how much he is removing with each cut. The objections to over-coagulation are sepsis and secondary hæmorrhage; however, the ultimate results of intraurethral operations depend largely on the personal skill and judgement of the operator. It is no job for the amateur cystoscopist. The patient should be in hospital, and needs careful pre-operative preparation. Those who regard it as a consulting-room procedure are either not resecting any tissue worth removing or are taking unnecessary risks in patients with doubtful lesions. Small fibrous prostates, bladder neck fibroses and median bars are best treated by intraurethral methods. Between the extremes of the large easily enucleable adenoma and the tough fibrous constricted vesical orifice, we have conditions such as the valve-like intravesical projection, the treatment for which varies according to the fancy of the surgeon. It should always be remembered that open operation gives the best chance of complete removal of the tumour; but complete removal is not always necessary, and, if it is possible to give a five- or ten-year freedom from prostatism by a minor procedure, this is often better for the elderly patient than the more severe operation. Resection is not suitable for large soft prostates. The operation is lengthy, and the risks of sepsis and secondary hæmorrhage are greatly increased by the large raw area left. The time factor is important in operations on the elderly; the large adenoma is most quickly removed by enucleation, the fibrous bar by resection. It has been argued against resection that the removal is only partial, and that recurrence is liable to occur; but it must be acknowledged that recurrences do occur after enucleations, and that attempted enucleations in unsuitable cases have not only a mortality rate, but, what is much more trying, an unpleasant morbidity.

Between 10% and 15% of hypertrophied prostates that have been thought to be non-malignant prove on section to be cancerous. It is possible in very early cases to enucleate the tumour without disseminating the growth, and in these better results must be expected with enucleation than with resection, when the small tumour may be overlooked and left behind; however, resection is useful in cancers which are causing obstruction, but which cannot be completely removed. Relief is given by cutting a passage through the growth, the remarkable feature being the manner in which the mucosa regenerates over the cut surface.

The prostate is passing through a very interesting stage of its history. What will the future hold? Let us hope something better than the not very æsthetic enucleation, or the partial procedure of resection. Perhaps endocrinology will solve many of our present problems.

SUMMARY.

An attempt has been made to demonstrate:

1. The necessity for accurate diagnosis in prostatic disease.
2. The value of prostatic massage and the microscopic study of prostatic secretion as a diagnostic aid.
3. The value of cysto-urethroscopy as an aid to diagnosis and treatment.
4. The indications for various methods of treating bladder neck obstruction with particular reference to enucleation, resection and endocrinology.

REFERENCES.

(1) P. Niehans: "Modern Views on Hypertrophy of the Prostate", *The Lancet*, February 8, 1936, page 307.

(2) A. Elliot-Smith: "Steinach II Operation for Prostatic Obstruction", *Proceedings of the Royal Society of Medicine*, Volume xxix, May, 1936, page 825.

(3) W. E. Lower, W. J. Engel and D. R. McCullagh: "Summary of Experimental Research on Control of Benign Prostatic Hypertrophy and Preliminary Clinical Report", *Journal of Urology*, Volume xxxiv, December, 1935, page 670.

(4) C. L. Deming, R. H. Jenkins and G. Van Wagenen: "Further Studies in Endocrinological Relationships of Prostatic Hypertrophy: Effect of Castration on Suburethral Glands in the Posterior Urethra of the Rat", *Journal of Urology*, Volume xxxiv, December, 1935, page 678.

(5) R. W. Barnes: "Toxic Hyperplasia of the Prostate Gland", *Journal of Urology*, Volume xxxv, January, 1936, page 70.

OBSERVATIONS ON ANÆSTHESIA IN CEREBRAL SURGERY.

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Major neurological surgery is becoming regarded as the province of a specially trained and equipped neurosurgical team. In such a team the anæsthetist plays a somewhat important part, and his duties and equipment are being more clearly defined. His task is not limited merely to the anæsthetization of the patient. It is proposed, in this paper, to set out the additional duties which fall upon the anæsthetist and to discuss the equipment needed by him. It might be said that this equipment should include a generous share of optimism and enthusiasm, as well as considerable physical endurance. Cerebral operations are long and exacting, and for hours together the life of the patient frequently hangs by a thread. The mortality has been greatly reduced in recent years, but is still relatively high, so that every member of a neurosurgical team must resign himself to finding his best efforts often thwarted. To the physical and mental strain of working under such conditions must be added the consideration that the results are frequently unprofitable from the standpoint of restoring the patient to economic efficiency, or even of relieving him of his immediate disorder. Whether surgeon or anæsthetist, the member of the neurosurgical team must reconcile himself to the prospect of much arduous and disappointing work for the sake of the occasional outstanding success which justifies the whole.

Statistical Basis of the Present Paper.

The present paper is based upon experience gained in seventy-seven operations upon the brain or spinal cord, performed in recent years upon sixty-three individual patients ranging in age from fifteen months to seventy-five years.

Five operations were performed by operators who were not specialists in neurosurgery. Two of the five were transsphenoidal decompressions of the pituitary fossa, carried out by a rhinologist. Both successfully arrested the progress of symptoms for three or four years, after which removal of the pituitary tumour was performed by a neurosurgeon, the patients appearing a second time in the series. The three remaining patients were operated upon by general surgeons, one for a tumour of the mid-brain and two for cerebellar tumours. All three succumbed, however, in the immediate post-operative period. The

seventy-two remaining operations were performed in the neurosurgical unit of Mr. H. C. Trumble at the Alfred Hospital in the years 1934 to 1936.

A brief statement of the operations performed and anæsthetics used is given in Table I.

TABLE I.

Operations Performed and Anæsthetics Used in 77 Cerebral and Spinal Operations upon 63 Individuals.

Operations.	Anæsthetic Used.						Total.
	Nitrous Oxide (Endotracheal).	Ether (Endotracheal).	Local Infiltration.	Local; Nitrous Oxide Supplement.	Local; Ether Supplement.	Local; Chloroform Supplement.	
1. Tumours:							
Frontal lobe		1	3		1	1	6
Parietal lobe	6		5				11
Temporal lobe			2				2
Pituitary fossa	4	4			1	1	10
Cerebellar fossa	4		3		2		9
Cerebello-pontine angle	3		1				4
Spinal cord	2						2
2. Exploratory[1]*:*							
Cerebral	7		7	2	1		17
Cerebellar			1	1	1		3
3. Various:							
Depressed fracture		1	1				2
Decompression		1					1
Gasserian radectomy	8	2					10
Total	34	9	23	3	6	2	77

[1] No tumour or cyst was found, although conditions of hæmatoma, arachnoiditis *et cetera* were at times observed. At other times no organic lesion could be localized.

It will be seen that gas anæsthesia was the most common choice; indeed, in recent months it has been almost exclusively preferred, even to the prejudice of local anæsthesia. The question of choice of anæsthetic will, however, receive detailed consideration below.

The subject of mortality is scarcely germane to a paper written wholly from the anæsthetist's angle. It is, however, desirable to give some indication of the death rate in the series. The mortality "on the table" and up to the time of the departure of the patient from hospital is, therefore, given in Table II. It is curious to observe that no fatality occurred "on the table" under a general anæsthetic; three such, however, took place under local anæsthesia. A fourth fatality occurred under local anæsthesia with ether supplement, although no ether had been given for twenty minutes before the sudden syncope which caused death. In the post-operative fatalities the principal causes of death were (*a*) medullary failure due to raised intracranial tension

resulting from œdema of the brain, (*b*) operative shock, (*c*) hyperthermia, (*d*) meningitis.

TABLE II.

Mortality ("on the table" and post-operatively) in 77 Cerebral or Spinal Operations upon 63 Patients.

Operation.	Cases.	Total Deaths.	Deaths "On Table".	Post-operative Deaths.
1. Tumours:				
Frontal lobe	6	2	1	1
Parietal lobe	11	4	1	3
Temporal lobe	2	1		1
Pituitary fossa	10			
Cerebellar fossa	9	3	1	2
Cerebello-pontine angle	4	2		2
Spinal cord	2			
2. Exploratory:				
Cerebral	17	5	1	4
Cerebellar	3	1		1
3. Various:				
Depressed fracture	2			
Decompression	1			
Gasserian radectomy	10			
Total operations	77	18 (23·4%)	4 (5·2%)	14 (18·2%)
Individual patients	63	18 (28·6%)	4 (6·4%)	14 (22·2%)

The details of the individual fatalities "on the table" would occupy too much space if given *in extenso*. They may be briefly summarized thus:

Case I was that of a child undergoing removal of a cerebellar tumour under local anæsthesia with ether supplement. The blood pressure fell sharply in the early stages of the operation and the *dura mater* was unwisely opened whilst the blood pressure was still low. The child had thus no reserve to withstand the effects of a brisk hæmorrhage encountered whilst the vascular supply of the tumour was being localized.

Case II was that of a woman undergoing removal of a meningioma of the *falx cerebri*. Two previous operations had been suspended on account of hæmorrhage from the very vascular growth. On this occasion bleeding was equally brisk and the blood pressure fell sharply. Owing to repeated previous transfusions of blood, it was difficult to find a patent vein. Valuable time was thus lost, and death occurred before enough blood had been infused to restore the weakened circulation.

Case III was that of a young man undergoing removal of a tumour of the frontal lobe. This was effected in about three and a half hours, and the wound was being closed, when, on account of low blood pressure, a transfusion of blood was given. In some way not understood, the coagulability of the patient's blood appeared to become impaired by this transfusion; free hæmorrhage commenced under the flap, from the cut bone edges and from the brain substance, necessitating reopening of the wound. Despite repeated transfusions during the next three hours, the patient became exsanguinated and died. The infused blood was apparently "compatible", and the reason for the disturbance of the patient's coagulation power remains obscure.

Case IV was that of a man admitted in coma, with convulsions and advanced circulatory failure. Cerebral exploration under local anæsthesia was attempted as a

last resort, but death occurred whilst the dura was being opened. The operation chart is reproduced (Figure I) as illustrating the manner of death in circulatory failure of central origin. In this chart the upper dotted line indicates the pulse rate. The upper continuous line shows the systolic blood pressure; the lower, the diastolic pressure. The two linked circles indicate readings of the respiratory rate. It will be seen that at 5.35 a.m. the pulse became imperceptible, the systolic blood pressure fell to 20 millimetres of mercury, and the diastolic pressure could no longer be estimated. The patient was apparently dead at 5.42 a.m., and life was definitely pronounced extinct eight minutes later.

DUTIES OF THE ANÆSTHETIST.

In the present series of cerebral operations the anæsthetist had a number of related duties to perform, as follows:

Pre-Operative Examination of the Patient.—Pre-operative examination of the patient included assessment of the surgical risk, ordering of premedication and choice of anæsthetic agent and technique. In general, these duties were carried out as if for general surgical operations, but certain special problems existed which will receive individual attention as this paper proceeds.

Administration of the Anæsthetic.—Local anæsthesia was, in this series, carried out by the surgeon. General anæsthesia was complicated by the fact that the anæsthetist seldom had direct access to his patient once the operation began. He had to depend then for information as to the patient's condition upon such respiratory movements as might be seen under the drapings, upon the briskness of bleeding and colour of the blood as reported by the surgeon or as shown by an occasional glimpse of the wound, and upon rare opportunities to observe the colour and temperature of the patient's hand or foot. For the rest, reliance had to be placed upon estimations of the blood pressure and pulse rate made by means of a long-tubed sphygmomanometer and stethoscope strapped to the patient's arm.

Keeping of an Operation Record.—Observations of the blood pressure, pulse rate, respiration rate, general condition of the patient and progress of the operation were made at intervals of five minutes. The readings were entered upon a chart of the type recommended by the International Anæsthesia Research Society and illustrated in the various figures in this paper. The chart-making compelled the anæsthetist to collect certain physical signs which were, in fact, his only means of assessing from time to time the condition of the patient. By recording these signs as observed it was possible to form a picture of the patient's condition at any stage and to compare it with the picture presented at any earlier stage. Only in this way could danger-signals be detected and the surgeon warned accordingly. The anæsthetist, being cut off from direct physical contact with the patient, had to rely on the chart for information as to the patient's condition. The surgeon, whose field of view was necessarily limited, was in turned obliged to rely upon timely reports from the anæsthetist.

The Combating of Shock.—It was the anæsthetist's duty, on the appearance of shock of the second degree, to acquaint the surgeon with

No. A.H. **Anesthetic Record** Age 65

Surgical Risk (A / B / C / D 1.) Sex M. Wt. AVERAGE.

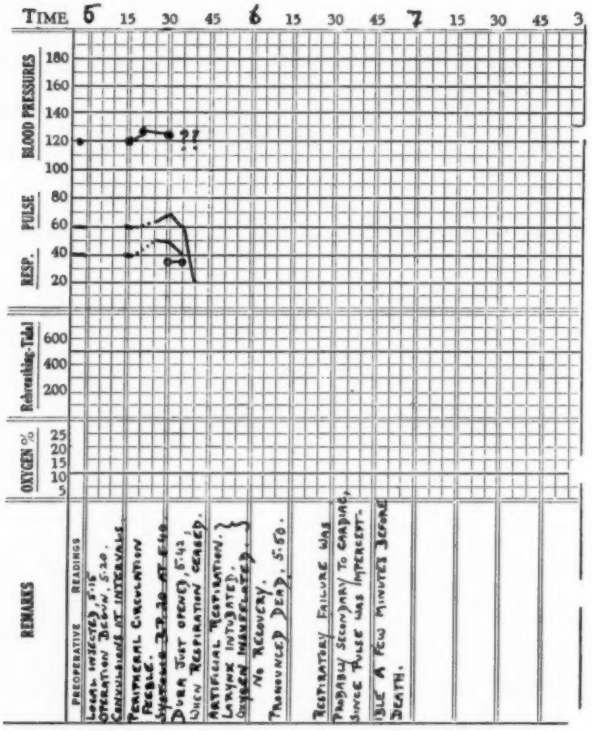
Physical Appearance, General UNEASY LOOKING. Facial Expression

Physical Conditions normal except CONVULSED AT INTERVALS, WITH PRECEDING TONIC PHASE & FORCED GRASPING L. HAND. GENERAL IRRITABILITY.

Operation CEREBRAL EXPLORATION. Time Begun 5.15 A.M.

Preanesthetic Hypnotic NIL. Dose —. Time of Admin —.

Anesthetic ETHACRINE Total Quantity ? Technic LOCAL.



Operative Complications Affecting Anesthetic or Convalescence

Degree Circ Depression During Operation (1st / 2nd / 3rd) end (1st / 2nd / 3rd)

FIGURE 1. Operation record: death from circulatory failure.

the fact, so that (*a*) the cause might be sought and possibly corrected, (*b*) no further extensive operative procedures might be undertaken until the patient's condition would permit of them. The occurrence of shock of the third degree was an indication to the anæsthetist to initiate remedial measures. These will be further discussed below, but may be said at this stage to have consisted in the application of warmth, intravenous infusion of saline solution or of blood and the postponement of further surgical procedures likely to cause much bleeding until after a transfusion had been given. The temptation existed for the anæsthetist to undertake such a transfusion himself, rather than to allow valuable time to be lost before an assistant could be spared for the purpose. It was found, however, that the anæsthetist was more useful when he remained at his post at the chart, reporting developments and suggesting what ought to be done, rather than himself trying to aid in active treatment.

Team work is the essence of cerebral surgery. The surgeon, upon whom the main responsibility falls, is compelled to delegate certain duties to his collaborators. He must look to his anæsthetist for the collecting of data regarding the patient's condition, and for the volunteering of early and accurate information as to untoward eventualities. Cerebral surgery provides ample scope to the anæsthetist for the collection of information in face of difficulties and for the improvision of technique to meet unforeseen demands.

ANÆSTHETIC EQUIPMENT.

The anæsthetic equipment employed in the present series of cases was as follows:

1. Local anæsthetic appliances were supplied by the hospital or by the surgeon.

2. Gas anæsthesia apparatus capable of delivering the anæsthetic mixture under positive pressure was found desirable, since oxygenation of the lungs may be carried out with it in the absence of voluntary respiratory movements. Central respiratory depression, necessitating this mechanical aid, was found to be a frequent concomitant of intracranial operations. The patients in this series who received gas were anæsthetized with the McKesson "Nargraf" apparatus, the recording mechanism of which much facilitates the keeping of a chart. The apparatus was checked before use for perfect order, and nitrous oxide was provided in abundant supply, allowing for a consumption of one hundred imperial gallons per hour of operation.

3. Laryngoscope and endotracheal catheters were kept always at hand, even if not employed initially, it being found that prompt intubation of the larynx and insufflation of oxygen might be required at any stage of the operation to overcome respiratory depression. Magill's rubber catheters and laryngoscope were employed in this series for ether and gas cases alike.

4. Apparatus for the endotracheal use of ether, of reliable design and in good order, was always available. If not required for anæsthesia, it was often employed to deliver a stream of air beneath the drapings covering the patient's head, adding much to his comfort when undergoing operation under local anæsthesia. Further, it was available for endotracheal insufflation of oxygen or of carbon dioxide-oxygen mixtures in cases of respiratory depression. An abundant supply of these two gases was kept at hand in case of need.

5. Stimulants were found of small avail; "Coramine" and pituitrin appeared to be the most effective. The best stimulant in cases of shock was intravenous infusion of saline solution or of blood, and an apparatus for continuous intravenous drip infusion was kept always at hand. This was generally placed in the charge of one of the surgeon's assistants, who was likewise responsible for the provision of donors of blood and for the collection of such blood when required.

PREMEDICATION OF PATIENTS.

Premedication offered a difficult problem in the present series of cases, on account of the impossibility of forecasting the response of a patient to a stated dose of any drug. The effect might prove to be either adequate, insufficient or excessive, whilst actual excitement at times resulted. Further, most narcotics in doses large enough to be effective depressed the respiratory and circulatory functions to some degree, which was undesirable, because cerebral operations were found to involve very great risk of such depression without having the patient already depressed by narcotics before the operation began.

Before local anæsthesia, the use of "Avertin" or of paraldehyde given by the rectum would seem at first sight to have much to commend it. These drugs are, however, powerful and depressing, for which reason they were not used in the present series of cases. Intravenously given barbituric acid derivatives are toxic and are evanescent in effect, as well as being physiologically opposed by the action of ethocaine. Initially, resort was made to orally administered barbiturates, such as "Sodium amytal" or "Nembutal", alone or in combination with morphine. They did not prove reliable, sometimes resulting in excitement rather than in sedation, and frequently lowering the blood pressure. On the whole, morphine proved the most consistently useful sedative, given in doses of 0·011 to 0·016 gramme (one-sixth to one-quarter of a grain), and combined with hyoscine in doses of 0·32 to 0·43 milligramme (one two-hundredth to one one-hundred-and-fiftieth of a grain).

Before gas anæsthesia the somewhat uncertain effect of premedication was again observed. Finally, a mild barbiturate sedative (such as barbitone, 0·45 gramme or seven and one-half grains) was given in the evening before operation and a hypodermic injection of morphine, from 0·011 to 0·016 gramme (one-sixth to one-quarter of a grain), in the morning one hour before operation. In very apprehensive patients barbitone was given in the evening before operation: "Nembutal", in a

dose of 0·09 gramme (one and one-half grains), was administered two hours before operation in the morning, and 0·011 gramme (one-sixth of a grain) of morphine was injected an hour later, if required.

Before ether anæsthesia, barbitone in a dose of from 0·3 to 0·45 gramme (five to seven and one-half grains) was given in the evening before operation; this dose was repeated in the morning an hour and a half before operation. Atropine, in a dose of from 0·43 to 0·65 milligramme (one one-hundred-and-fiftieth to one one-hundredth of a grain), was given thirty minutes later.

In children, general anæsthesia was regarded as definitely preferable to local anæsthesia. No sedative was given to infants and small children, but those of or above the age of eight years received 0·3 gramme (five grains) of chloretone an hour and a half before operation.

METHODS OF PRODUCING ANÆSTHESIA.

Local Anæsthesia.

Local anæsthesia has the cardinal advantage that it does not add anæsthetic depression to the depression produced by the operative procedures. Further, it is economical. It has, however, the grave disadvantage of involving the patient in the distressing ordeal of remaining conscious throughout a prolonged operation. It should, therefore, be combined with adequate premedication, although premedication which is adequate and yet not depressing is difficult to achieve. Of the patients in the present series who received local anæsthesia, most (unless fortunate in their response to sedation) found the actual injection and the raising of the osteo-periosteal flap painful. The trephining of the skull was definitely reported as unpleasant. Once the skull was opened, however, the patients were relatively comfortable. Even so, they had to lie in a fixed position, conscious, throughout an operation lasting for several hours, and they frequently overheard remarks which it was very undesirable for them to hear. When the time came for closure of the scalp, the local anæsthetic had largely passed out of the tissues and inhalational anæsthetic supplement was often necessary. In the last months of the series, then, general anæsthesia was almost exclusively preferred to local anæsthesia.

Inhalational Supplement to Local Anæsthesia.

Inhalational supplement to local anæsthesia proved a difficult and dangerous procedure, because the anæsthetist had no proper access to the patient. It was found better, therefore, to give general anæsthesia from the start and by the endotracheal method if there was reasonable prospect of any general anæsthetic being required at all.

When it became necessary, however, to supplement local anæsthesia, several methods were available. With gas, the patient's position at times admitted of a mask being adjusted to the face under the drapings. With the patient in a prone position, resort was had to a device contrived by Mr. H. C. Trumble. The bottom of a boot-polish tin was

cut radially from centre to periphery and everted so as to form a series of rays surrounding a central ring, as shown in Figure II (A and B). The rays were incorporated in the plaster of Paris head-rest, a gap being left in this last opposite the patient's mouth and nose. The tin ring was arranged so as to form a ledge around this gap (C). The patient under local anæsthesia then lay with his face and head supported by the plaster head-rest, but he received air and a measure of daylight through the tin-lined gap. Meanwhile, the lid of the boot-polish tin

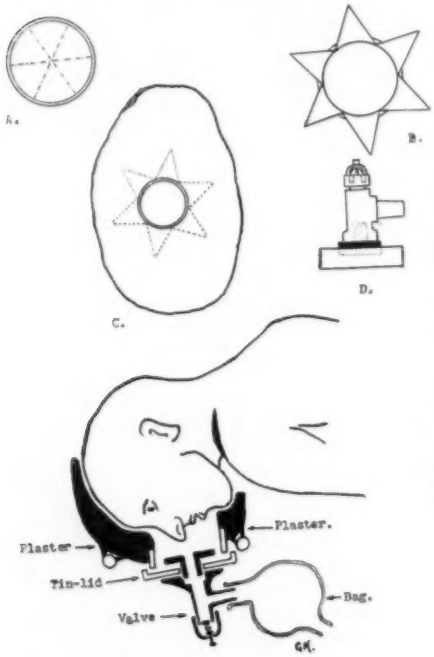


FIGURE II. Trumble's device for administration of anæsthetic supplement, oxygen or carbon dioxide-oxygen mixture to patients in the prone position. The bottom of a boot-polish tin is marked out and cut as at A. The cut segments are bent back into the form of a corona, as at B. The closely fitting plaster head-rest is made with a gap over the mouth and nose (by covering these with an anæsthetic mask whilst making the plaster), and the corona is incorporated as at C, the body of the tin forming a ledge around the gap. The tin lid is now cut out to admit the threaded locking-stem of a McKesson gas anæsthetic valve, 1929 pattern; the body of the valve is screwed onto the stem externally, with a washer between it and the tin, as in D. When it is desired to administer oxygen or anæsthetics, the tin lid, with its valve, is slipped onto the body of the tin incorporated in the plaster, and the bag or delivery tube of an anæsthetic machine is attached to the valve, as shown at E.

was cut out to take a McKesson anæsthetic valve (D), to which was affixed a one gallon rubber bag. When gas anæsthetic supplement was required, the lid was slipped onto the tin ring, gas and oxygen were delivered into the bag, and the patient's exhalations escaped through the valve. The plaster head-rest forms so good a fit that it was found quite practicable to conduct gas anæsthesia in this way. When a McKesson machine was available, its delivery tube could be attached directly to the valve, and this enabled the anæsthetist to dispense with the bag. The main drawback to the method lay in the fact that respiration was not under direct control, as in endotracheal anæsthesia. Access to the patient being also very limited, caution was necessary

against overdosage. The method was never intended to replace endotracheal anæsthesia, but only to meet the occasional urgent need for giving oxygen or inhalational anæsthetic supplement to the patient under local anæsthesia.

With ether, several means of supplementing local anæsthesia were also available. It was usual, when the patient was in the supine position, to place over his face a wire hoop clamped to the ring supporting the plaster head-rest. From this hoop was suspended a wire gauze framework which rested, at its free end, upon the patient's chest. The object of this framework was to keep the drapings away from the patient's face (Figure III). For purposes of ventilation, a stream of air was played continuously over the patient's face, the stream being derived from an electrically operated endotracheal ether machine. The delivery tube from the machine was attached to the wire gauze framework beneath the drapings. It was, therefore, a simple matter to add more or less ether vapour to this air by means of the control tap on the ether machine. A similar device was contrived for use when the patient lay in the lateral position. When he was in the prone position, recourse was had to the boot-polish tin device, with bag and valve, which has been described above. Attempts to do without the valve and to allow the patient to inhale and exhale ether-laden air through a tube of wide calibre were soon given up; the amount of dead space in so long and wide a tube was sufficient to interfere with respiratory exchange and to produce anoxæmia.

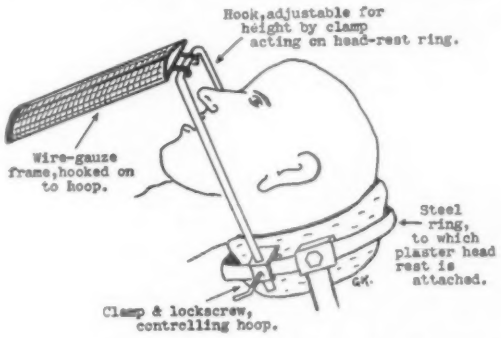

Hook, adjustable for height by clamp acting on head-rest ring.
Wire-gauze frame, hooked on to hoop.
Steel ring, to which plaster head rest is attached.
Clamp & lockscrew, controlling hoop.

FIGURE III. Device for keeping the drapings away from the patient's face when in the supine or lateral position. A steel wire hoop spans the face and is attached by yokes and clamping screws to the ring which supports the plaster head-rest. A wire frame, provided with hooks to engage the hoop and covered with wire gauze, keeps the drapings from touching the face. The delivery tube from an ether anæsthetic machine (set for "full air") may be attached to the underside of this frame, and serves to ventilate the space around the patient's face.

Chloroform as a means of supplementing local anæsthesia was abandoned after a brief trial as being too depressing. Supplement with ether or nitrous oxide-oxygen was limited to analgesia merely; it was not thought desirable to aim at full surgical anæsthesia, since the patient's respiration was not under direct control. It was found sufficient to relieve pain and tedium without necessarily abolishing movement or phonation. The presence of the anæsthetist was no less necessary with local than with general anæsthesia, not only because

inhalational supplement might be required from time to time, but because the need for observation of the patient and for charting of physical signs remained the same in either case.

Ether Anæsthesia: Endotracheal Method.

Ether anæsthesia by the endotracheal method, and preferably by inhalation as opposed to insufflation, was found applicable to certain cerebral operations. The main drawbacks to its use were circulatory and respiratory depression and fear of fire. Ether in small doses may be a cardiac and respiratory stimulant, but on prolonged administration it is a depressant. For this reason, its use was limited to robust patients and to operations productive of relatively little shock, such as removal of a pituitary tumour.

The danger of fire is with ether an even greater drawback than its depressant properties. Few cerebral operations are performed without the diathermy apparatus being used, and sparks are readily produced by this appliance, either at the spark-gaps or at the point of contact of the electrode with the patient. Further, an increased electrical potential may become manifest in the patient, with a possible discharge of "static" electricity. The danger of ether becoming ignited by a spark from the diathermy apparatus is thus real, and may imply serious consequences to the patient and to everyone in the operating theatre. If oxygen is added to the ether vapour, an explosion, and not merely a fire, may occur in such circumstances. Ether was given in several cases in the present series in which the diathermy apparatus was employed. That no accident occurred was perhaps due to the exhalation valve attached to the endotracheal catheter being so placed that it could discharge freely towards the floor, the ether vapour being separated from the field of operation by layers of drapings which soon became wet and more or less impervious to ether. This fact is, however, in no sense a safeguard, and ether was always used with great misgiving.

Nitrous Oxide.

Nitrous oxide was regarded as the anæsthetic of choice for cerebral surgery, the other anæsthetic gases being contraindicated by their inflammability. It should be remembered that the addition of ether to a nitrous oxide-oxygen mixture renders it highly explosive. This fact introduced a problem in those cases in which the patient was difficult to anæsthetize with gas alone. When ether supplement had to be employed, care was taken to do so only when the diathermy apparatus was not in use and to discontinue it as long as possible before the apparatus was again requisitioned. For this reason, a point was made of disconnecting a terminal of the diathermy apparatus before ether supplement was added, so that the apparatus could not be used without the anæsthetist's knowledge. However inconvenient to the surgeon, this course lessened the risk of a serious explosion due to the possible ignition by a spark of the nitrous oxide-oxygen-ether mixture.

The relative freedom from toxicity of nitrous oxide was well illustrated in the present series. One patient, aged seventy-five years, was anæsthetized for two and a half hours; a baby, aged fifteen months, was anæsthetized for two and three-quarter hours, and a young man for six and a quarter hours.[1]

Endotracheal administration was practically obligatory, not only to remove the anæsthetist from the field of operation, but also to give him control over the patient's respiration. The technique was based upon that of Magill. A small addition of ether vapour usually preceded the intubation of the larynx, being rarely contraindicated and greatly facilitating this procedure. When inserted, the catheter was so fixed as to preclude the possibility of its becoming dislodged during the operation. This was achieved by wrapping the catheter around, close to the Magill's elbow-piece, with adhesive strapping. A thread suture was then passed through both the collar of adhesive strapping and the skin of the patient's cheek, close to the angle of the mouth on whichever side was most convenient.

The administration, from this stage onwards, resembled that of endotracheal gas anæsthetics in general surgery. Certain special problems of respiratory and circulatory depression will receive detailed consideration below. Very light anæsthesia usually sufficed. Reference to the charts reproduced in this paper will show that, once the osteo-periosteal flap had been raised, percentages of oxygen could be given which would be unlikely to be used in general surgery. Indeed, 80% or 90% of oxygen was frequently employed during manipulation of the brain itself, especially when that manipulation resulted in circulatory depression. From every angle, light anæsthesia was to be favoured. Hence a deliberate attempt was made from time to time to ascertain what might be termed the upper limit of oxygen tolerance, that is, the highest concentration of oxygen which would be tolerated by the patient without movement, coughing or other signs of unduly light anæsthesia. Failure to ascertain this upper limit would mean that the patient might be carried at an unnecessary depth of anæsthesia, a fact which might in the course of hours add materially to the shock produced by the operation. Once the brain was exposed, anæsthesia could be so light that the patient might occasionally move a hand or foot, thus indicating a reduction by 1% or 2% of the hitherto rising concentration of oxygen. Needless to say, actual restlessness was to be avoided as adding to the amount of bleeding and seriously inconveniencing the surgeon, as well as possibly leading to injury to the brain substance.

Where the upper limit of oxygen tolerance was defined from time to time, there was little risk of the patient's becoming anoxæmic. Anoxæmia is always liable to throw a crushing load upon the heart and

[1] The two patients last mentioned did not ultimately recover. Both suffered from enormous tumours, of which it was practicable to remove only a part. The baby succumbed to hyperthermia twenty-four hours after operation, and the young man to sudden medullary failure, consequent on cerebral œdema, thirty-six hours after operation.

cerebral centres, especially if these be impaired by injury or disease. The danger of even a minor degree of anoxæmia to a patient undergoing a cerebral operation, and therefore exposed to extreme operative shock for hours together, needs no elaboration. Further, cerebral operations frequently require the patient to be placed in a position unfavourable to free respiration, but, with an endotracheal catheter in position, the patency of the airways may be assured unless the catheter becomes kinked.

The use of rebreathing was found to be a somewhat two-edged weapon. In the interests of economy, the anæsthetist is tempted to practise a high degree of rebreathing, which may result in an unduly high concentration of carbon dioxide in the blood. The respiratory centre, thus over-stimulated, may fail as a result of fatigue. The presence in any patient of hyperpnœa or sweating was therefore regarded with suspicion, as being possibly due to over-rebreathing. Fortunately, it was rare to find such a nice fit of the catheter in the larynx as would (even when reinforced by packing) prevent all escape of gas around the tube. When such a leak exists, over-rebreathing is unlikely to occur.

SHOCK.

Shock, as manifested by a catastrophic fall in blood pressure, was found to be the most serious concomitant of cerebral surgery. The picture of shock differed, however, from that observed in general surgery. McKesson's familiar classification, based upon the rise in pulse rate and fall in blood pressure, was found no longer to apply. The decline in blood pressure was encountered consistently, but the pulse rate might rise, fall or be little modified. McKesson's three degrees of shock, so convenient when speaking of other problems, were clearly not altogether applicable to these cases.

Most cerebral operations, if sufficiently prolonged, appeared to result in a gradual decline in blood pressure, which might finally reach alarmingly low values. In cerebral, as in general, surgery the rule would seem to apply that the patient must not be left for more than twenty minutes with a systolic blood pressure lower than eighty millimetres of mercury or a diastolic lower than sixty. If he be so left, the cerebral centres, the heart and kidneys are insufficiently supplied with blood, a vicious circle of anoxia is set up and the patient is likely to succumb either then or within the next forty-eight hours. Prompt treatment is therefore necessary, as will be later described. An illustration of this slow, gradual onset of circulatory depression is given in Figure IV, which shows a fall in blood pressure of forty millimetres of mercury during two and a half hours, without any critical stage being reached.

In this chart the upper continuous line indicates the systolic blood pressure; the line immediately below it is the diastolic pressure. The immediately subjacent dotted line indicates the pulse rate, and the dotted line below that again the respiration rate. The T's indicate readings, from time to time, of the tidal capacity of the lungs. The faint dotted line below indicates the volume of rebreathed gas mixture in hundreds of cubic centimetres. The lowest continuous

No. P 623. **Anesthetic Record** Age 52.

Surgical Risk A B C D ✓ Sex M. Wt. LARGE.

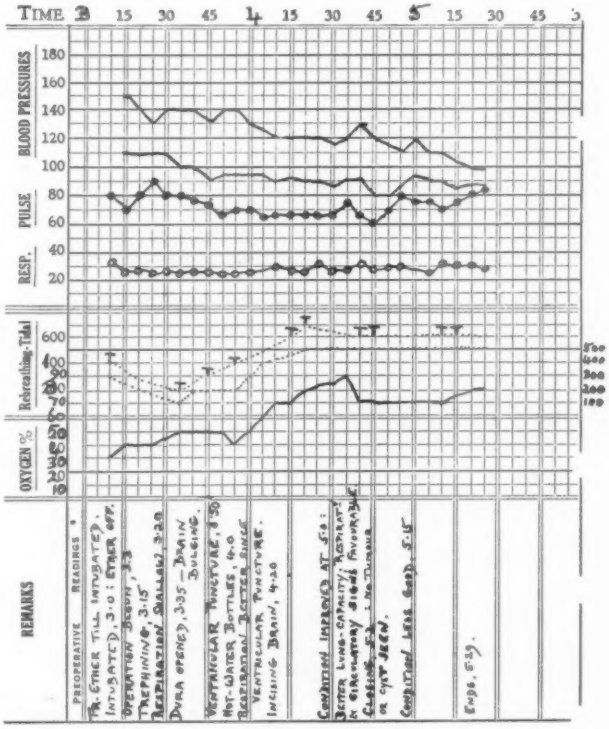
Physical Appearance, General SEMI-COMATOSE. Facial Expression

Physical Conditions normal except ADMITTED IN COMA: B.P. 120/80 NOW, 2 HOURS LATER, RESTLESS — COLDER.

Operation CEREBRAL EXPLORATION. Time Begun 2.55 P.M.

Preanesthetic Hypnotic NIL. Dose — Time of Admin —

Anesthetic N_2O-O_2 Total Quantity — Technic ENDOTRACHEAL.



Operative Complications Affecting Anesthetic or Convalescence NEGATIVE.

CONSCIOUS NEXT DAY & D.D WELL, THOUGH FINAL OUTCOME IS GLOOMY. NO VOMITING.

LARYNGITIS POST-OPERATIVELY: EVIDENCE SUGGESTS CHEMICAL ORIGIN FROM IMPERFECTLY WASHED CATHETER.

Degree Circ Depression During Operation 1st ___ 2nd ✓ 3rd ___ end 1st ___ 2nd ✓ 3rd ___

FIGURE IV. Operation record: gradual circulatory depression.

line shows the oxygen percentages in the gas mixture. It will be seen that there was a slow decline in blood pressure in the latter part of the operation, associated with little rise in pulse rate. Respiration, which was at first shallow, improved greatly after the intracranial tension had been lowered by ventricular puncture. This chart is "decoded" from a McKesson "Nargraf" record, the size of which renders it unsuited to publication.

At times, however, from such causes as direct cerebral interference or hæmorrhage, the fall in blood pressure was catastrophic. The anæsthetist might notice that respiration had become shallow and the patient's skin cold, pallid and damp. The blood pressure might be undetectable and the pulse slow and possibly irregular, every third or fourth beat being "missed". (Pulse changes were, however, extremely variable.) The surgeon might draw attention to the fact that the brain was shrunken and less pulsatile than formerly; less blood was flowing, and what was flowing might be dusky. The patient was, in fact, moribund, although yet capable of responding in a remarkable fashion to treatment if it were prompt and thorough. Cases of this type are illustrated in Figures V and VI. In the former case, shock resulted from the rapid release of a high intracranial tension following ventricular puncture. In the latter case, a critical fall in blood pressure resulted from hæmorrhage. Treatment induced a recovery, but another and even graver fall followed a further hæmorrhage. Yet again treatment was efficacious.

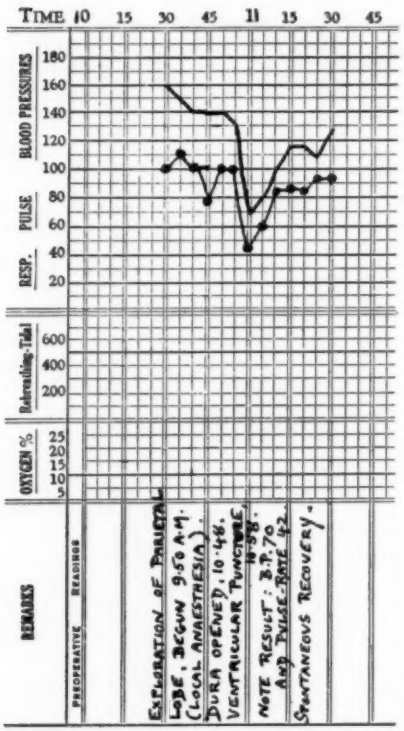


FIGURE V. Portion of operation record: effect of ventricular puncture.

Figure V is derived from a record otherwise of no particular interest. The continuous line indicates the systolic blood pressure; the dotted line, the pulse rate. About one hour from the commencement of operation ventricular puncture was performed, resulting in a very abrupt fall in blood pressure. This, however, recovered spontaneously. A similar catastrophic fall in blood pressure, not uncommonly seen after diagnostic ventriculography, especially in patients with high intracranial tension, may necessitate the urgent performance of craniotomy.

The notation in Figure VI is the same as that used in Figure IV. For the first two hours the blood pressure was well sustained, and only an irregular and progressively more rapid pulse gave evidence of circulatory strain. A catastrophic

fall in blood pressure then occurred, caused by hæmorrhage whilst the tumour was being removed. This was checked by intravenous therapy, but recurred an hour later, again from hæmorrhage. Intravenous therapy once more restored the blood pressure, but a further decline occurred towards the end of the operation. Intravenous saline infusion had now less effect than previously, but raised the blood pressure to a point from which spontaneous recovery was possible.

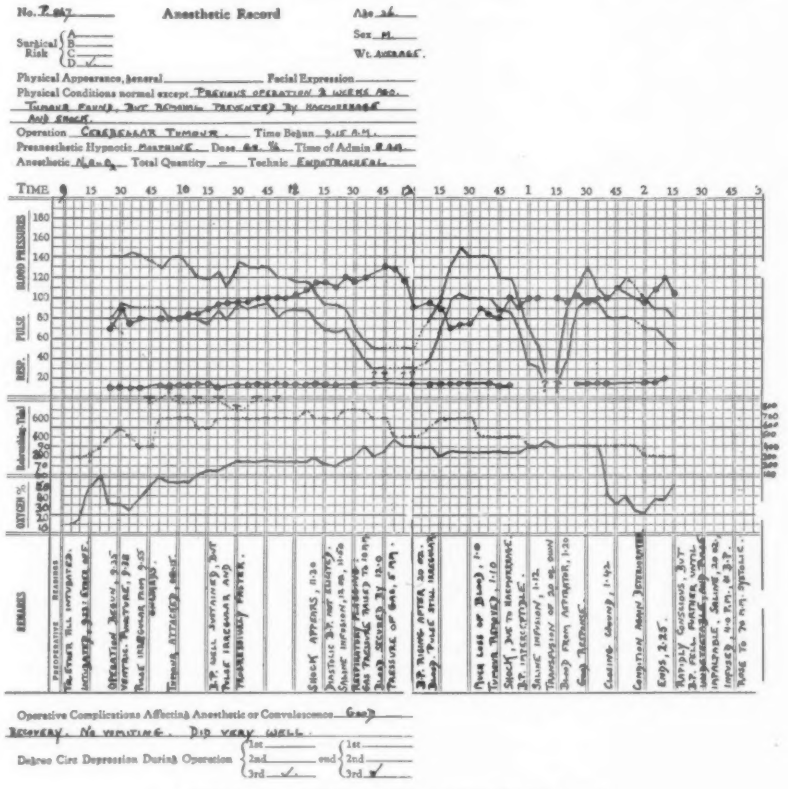

No. 7847
Anesthetic Record
Age 26
Sex M.
Wt. AVERAGE.
Surgical Risk A B C D
Physical Appearance, General
Facial Expression
Physical Conditions normal except PREVIOUS OPERATION 2 WEEKS AGO. TUMOUR FOUND, BUT REMOVAL PREVENTED BY HAEMORRHAGE AND SHOCK.
Operation CEREBELLAR TUMOUR. Time Began 9.15 A.M.
Premedication Hypnotic MORPHINE Dose gr. ¼ Time of Admin 8.45
Anesthetic N2O+O2 Total Quantity — Technic ENDOTRACHEAL.
TIME
BLOOD PRESSURE
PULSE
RESP.
Inhalation Vol
OXYGEN %
REMARKS
Preoperative Reasons
Operative Complications Affecting Anesthetic or Convalescence GOOD
RECOVERY. NO VOMITING. DID VERY WELL.
Degree Cire Depression During Operation 1st 2nd 3rd — end 1st 2nd 3rd

FIGURE VI. Operation record: hæmorrhagic shock.

Respiratory flagging was also noted, necessitating administration of the anæsthetic at positive pressure to assist the patient's respiratory efforts. Figure VI is "decoded" from a McKesson "Nargraf" record.

The causes of shock, then, appeared to be capable of classification as follows: (i) loss of body heat; (ii) loss of blood, especially if sudden; (iii) abrupt changes in cerebral tension, as after ventricular puncture; (iv) laceration of tissue resulting from the operation, often followed by reactionary œdema; (v) direct interference with cerebral centres,

especially in operations upon the brain stem; (vi) anoxæmia, whether due to postural embarrassment, to deficiency of oxygen in the atmosphere supplied or to kinking of an endotracheal catheter; (vii) anæsthetic overdose.

Prophylaxis of Shock.

Prophylaxis was suggested by the causal factors. Care was taken to keep the patient warm with blankets and hot water bottles. Every effort was made to minimize loss of blood. Ventricular fluid was allowed to escape gradually, especially in the case of patients accustomed to a high intracranial tension. The posture of the patient was, when possible, adapted to the needs of free respiration. Anæsthetic technique was directed towards ensuring the patency of the airways and the giving of the highest possible concentration of oxygen.

Treatment of Shock.

Treatment consisted primarily in replacing the lost body fluid. A blood transfusion was therefore initiated and, whilst the blood was being collected, normal saline solution was infused intravenously. As time is of fundamental importance, no attempt was made to insert a needle into a vein for purposes of infusion. The veins being invariably collapsed in severe shock, needling was foredoomed to failure. A long incision was made across the course of a large and constant vein, for example, the saphenous vein at ankle or knee, and a canula was inserted into it. Since it may be difficult to find a vein in the blanched tissues of severe shock, only large venous trunks were sought. If they were not quickly found, it was proved better to expose an arm and to seek a vein in the region of the elbow rather than to waste valuable time in dissecting the lower limb.

When the vein had been found, saline solution was infused by the drip method. The result was usually good, but evanescent. Blood was accordingly obtained from a donor whilst the saline infusion was proceeding. The amount of saline solution infused was from one-half to one pint, given slowly to avoid cardiac embarrassment. As soon as the blood was available, it was substituted for the saline solution and allowed to flow by the drip method. The amount of blood required depended mainly on the quantity lost at operation; not more than one pint was, however, given at a time. If the blood pressure were restored to a reasonable figure (say, one hundred millimetres of mercury) by a less quantity, the remainder of the blood was reserved in case a second transfusion were required.

Until the effect of the transfusion was noted, it was found best to suspend the operation after hæmostasis was secured. In the absence of response, further operative procedures would be likely to end in a fatality; the wound was therefore closed and another operation was undertaken at a later date. It was usual, however, for the patient's condition to show some improvement. The degree of that improvement gave the clue as to whether the operation might be resumed. Clearly,

a small response would not justify such a step as the opening of the dura, a step which is but the prelude to long and trying operative procedures and one from which retreat becomes difficult should the patient's condition again deteriorate. In general, therefore, it was regarded as unwise to open the dura if the patient's blood pressure were less than one hundred millimetres of mercury.

It sometimes happened that shock developed at a stage from which no rapid retreat was possible; for example, during the actual removal of a tumour. In such case operation was suspended as soon as possible, so as to obviate further gross loss of blood before a transfusion had been given. With an adequate response from this transfusion, the removal of the tumour was resumed; an inadequate response, however, indicated retreat from the operation as soon as it might safely be accomplished. Two-stage operations are undesirable on account of the enhanced risk of sepsis, but it is preferable to secure a living patient upon whom to perform a second operation rather than to cause a fatality by undertaking too much in the presence of a dangerously low blood pressure. Amongst the most anxious cases were found those in which, on account of free hæmorrhage, it was not possible to suspend operation and allow the patient a chance of recuperation; it was then necessary to give an almost continuous transfusion of blood in the hope of preventing the patient from becoming exsanguinated.

As mentioned above, it was usual for the patient's condition to respond to blood transfusion and a period of waiting. The operation was then resumed. Shock, however, was liable to recur at a later stage as the result of further trauma and loss of blood. In that case, a further blood transfusion (preceded, if necessary, by infusion of saline solution) was given, as is shown in Figure VI. Unfortunately, repeated blood transfusions often lose their effect, and even the second transfusion may be inefficacious. In such case, the operation had to be abandoned as soon as practicable, to be resumed another day.

So far, reference has been made principally to shock due to hæmorrhage. Shock due to other causes, such as direct cerebral interference, is in a somewhat different category. Transfusion in such cases, when little blood had been lost, appeared to throw a load upon the circulation, and infusion of saline solution was found preferable. This last is not long retained in the circulation, but the transient elevation of blood pressure which it produces was generally sufficient to overcome the shock. The operation was suspended until the patient showed signs of circulatory recovery.

The technique of blood transfusion was regarded as a matter for the surgeon and his assistants rather than for the anæsthetist. The latter was expected to have, however, a clear conception of the character of shock and the rôle of intravenous therapy, so that he might advise the surgeon appropriately. He had to aid in deciding whether the shock was due to cerebral disturbance, such as the sudden liberation of ventricular fluid which was under increased pressure, or to loss of

blood. In the former case, temporary suspension of the operation and the infusion of saline solution might lead to recovery; if they did not, the operation might have to be performed in stages. Shock due to hæmorrhage was regarded as calling for saline infusion as soon as the blood pressure fell to a value of ninety millimetres of mercury. Blood transfusion was initiated as soon as possible, and no further loss of blood from the wound was risked until this transfusion had proved effective. If it proved ineffective, the operation might have to be temporarily abandoned. Otherwise the operation continued, but the anæsthetist was required to report any subsequent manifestation of shock, with a view to its prompt treatment by further transfusion. The possibility of again resuming the operation was based upon the patient's response to this repeated transfusion.

Other remedies for shock were found of minor value. The patient's head, which was ordinarily kept raised so as to minimize venous oozing and thus facilitate the surgeon's task, was lowered as much as practicable in order to improve the cerebral circulation. The body heat was maintained by hot water bottles. Drugs proved of small avail, since they represent "flogging the spent horse"; sometimes they served, however, in helping to tide over a crisis until blood transfusion could be initiated. For this purpose, pituitrin was given subcutaneously in a dose of one cubic centimetre, combined with three cubic centimetres of "Coramine". Once or twice, in grave emergencies, these drugs proved ineffective owing to their absorption being delayed by the slow peripheral circulation. "Coramine" or three minims of adrenaline were therefore given intravenously to provide a temporary stimulus to the circulation. As the collapsed veins of shock are difficult to find, a cerebral sinus was on occasion requisitioned for the purpose.

A form of "shock" different from the preceding was encountered, and is illustrated in Figure VII. Nothing catastrophic was observed, but there was a slow, steady decline in blood pressure, with a progressive slowing down of pulse rate and respiration rate. The respiration became slower and developed periodic intermissions. This picture is not peculiar to cerebral surgery, and probably represents a flagging of all vital functions. The patient has apparently insufficient reserves of energy to withstand the strain of operation and of anæsthesia. The problem is merely one of whether the operation can be completed before the patient's reserves become exhausted.

RESPIRATORY EMBARRASSMENT.

Irregularity or shallowness of respiration was found to result from cerebral interference and from anæsthetic overdose. It also occurred as a result of asphyxia due to kinking of an endotracheal catheter, to pressure of the edge of the plaster head rest against the patient's neck and even (in certain cases) to the position in which the patient's head lay relatively to his trunk.

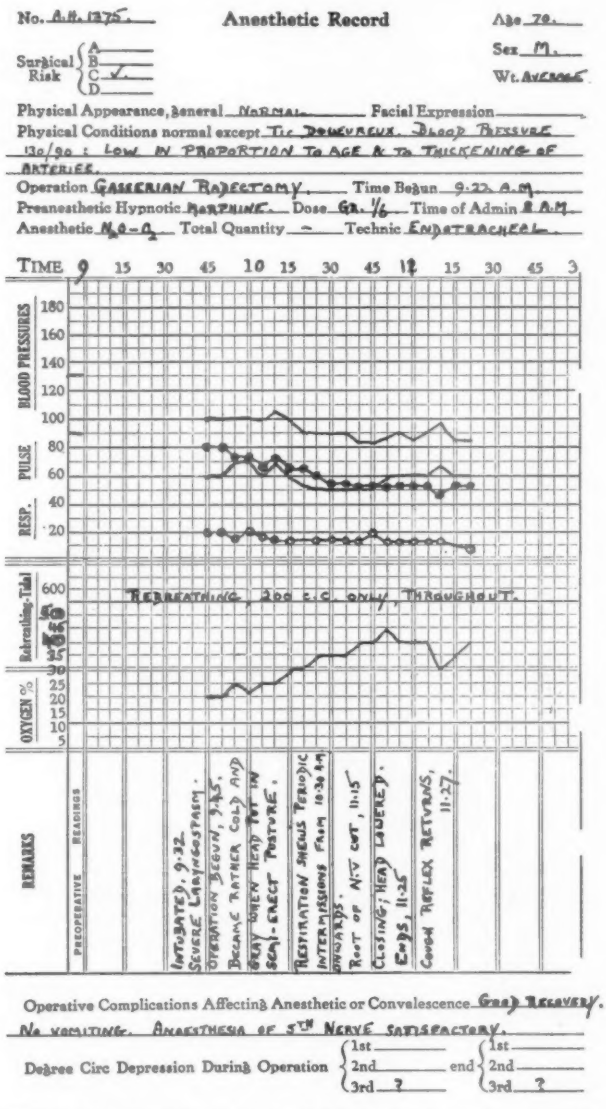

No. A.H. 1375.
Anesthetic Record
Age 70.
Sex M.
Wt. AVERAGE
Surgical Risk A B C V. D
Physical Appearance, General NORMAL. Facial Expression
Physical Conditions normal except TIC DOULOUREUX. BLOOD PRESSURE 130/90 : LOW IN PROPORTION TO AGE & TO THICKENING OF ARTERIES.
Operation CAESERIAN RADICTOMY. Time Begun 9.22 A.M.
Preanesthetic Hypnotic MORPHINE. Dose Gr. 1/6 Time of Admin 8 A.M.
Anesthetic N2O-O2 Total Quantity ~ Technic ENDOTRACHEAL.
TIME 9 15 30 45 10 15 30 45 11 15 30 45 3
BLOOD PRESSURES
PULSE
RESP.
180 160 140 120 100 80 60 40 20
Rebreathing-Tidal
OXYGEN %
600 35 30 25 20 15 10 5
REBREATHING, 200 C.C. ONLY, THROUGHOUT.
REMARKS
PREOPERATIVE READINGS
INTUBATED, 9.32.
SEVERE LARYNGOSPASM.
OPERATION BEGUN, 9.45.
BECAME RATHER COLD AND GRAY WHEN HEAD PUT IN SEMI-ERECT POSITION.
RESPIRATION SHOWS PERIODIC INTERMISSIONS FROM 10.30 A.M. ONWARDS.
ROOT OF N.V. CUT, 11.15
CLOSING; HEAD LOWERED.
ENDS, 11.25
GOOD REFLEX RETURNS, 11.27.
Operative Complications Affecting Anesthetic or Convalescence GOOD RECOVERY.
NO VOMITING. ANAESTHESIA OF 5TH NERVE SATISFACTORY.
Degree Circ Depression During Operation 1st 2nd 3rd ? end 1st 2nd 3rd ?

FIGURE VII. Operation record: deficient circulatory reserve. The notation is the same as that employed in the previous figures.

Hæmorrhagic shock was associated with depression of respiration as well as of circulation. This is illustrated in Figure VI, where, after a critical fall in blood pressure had occurred, it was found necessary to increase the pressure of delivery of the gas mixture so as to facilitate respiration. Similar assistance was at times required as a result of direct manipulation of the brain, or of sudden release of high intracranial tension.

Patients with lesions of the posterior cerebral fossa, especially if associated with high intracranial pressure, were found to be very intolerant of flexion of the neck upon the trunk. For some reason which is not clear, flexion was frequently followed by respiratory obstruction, which at times had serious consequences. A case of this type is illustrated in Figure VIII.

On flexing the patient's neck to give access to the posterior fossa, grave asphyxia resulted, so depressing the circulation that it failed to recover after the asphyxia had been relieved. As it is unsafe to proceed in the presence of a low blood pressure, the operation had to be temporarily abandoned.

A yet more serious instance of the same phenomenon is illustrated in Figure IX.

The patient suffered from a tumour in the fronto-sphenoidal area causing extremely high cerebral tension; the symptoms were of the *contre coup* type and directed attention to the posterior cerebral fossa, which was accordingly explored. Postural asphyxia occurred during the operation and caused hæmorrhage into the tumour. The consequent rise in cerebral tension was such that the cerebellum was dislocated from the posterior fossa, strangulated against the cut edges of the bone, lacerated and filled with extravasated blood. Death, of course, finally resulted.

Subsequent patients with posterior fossa disease or with high intracranial tension in the present series were operated upon under general anæsthesia for the sake of being able to employ an endotracheal catheter. With this in place, the patient was assured of a patent airway under all conditions.

Endotracheal anæsthesia, then, found its use in safeguarding the patency of the airways and in sustaining the patient's respiratory functions in times of crisis. Cases in which the respiratory function has entirely failed, necessitating endotracheal insufflation of air or oxygen to maintain life, will have come within the experience of most anæsthetists either in cerebral or general surgery. In the writer's experience such patients have not ultimately recovered; respiration may have been carried out for long periods in the absence of voluntary movements, but sooner or later the circulation has succumbed. Even in less extreme cases, such as those in which voluntary respiration has persisted, but so feebly as to require mechanical aid throughout the operation, death has always ensued in the post-operative period. The writer is led to suppose that a disease process capable of inflicting lasting injury upon the respiratory centre must do equal damage to the circulatory centre. This is borne out by a case of cocaine poisoning seen by the writer. Failure of respiration occurred within a few minutes

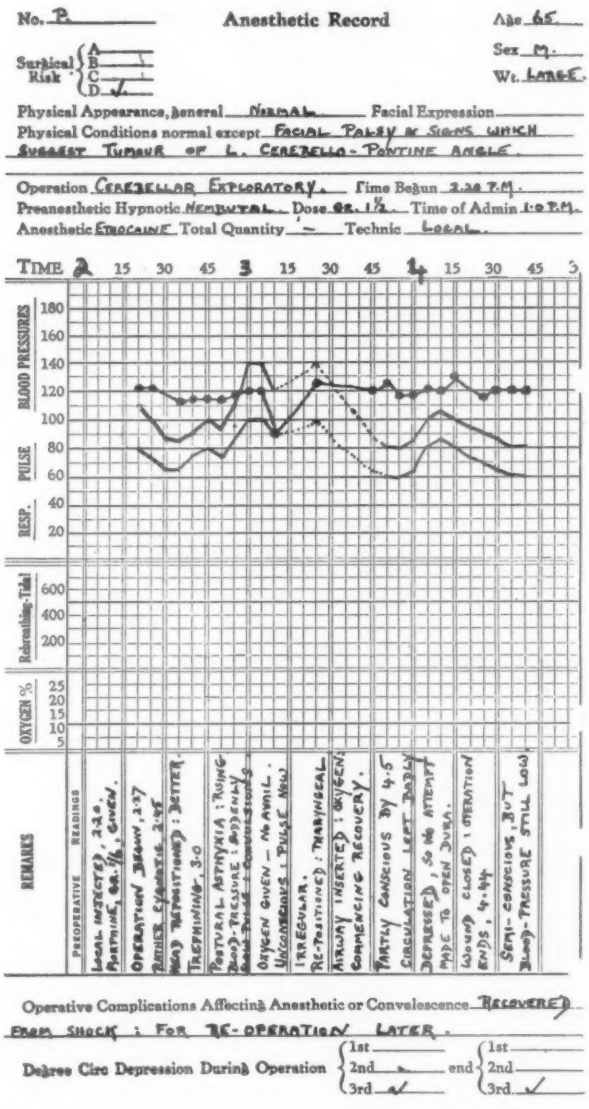

No. P.
Anesthetic Record
Age 65
Sex M.
Wt. LARGE
Surgical Risk A B C D ✓
Physical Appearance, General NORMAL. Facial Expression
Physical Conditions normal except FACIAL PALSY & SIGNS WHICH SUGGEST TUMOUR OF L. CEREBELLO-PONTINE ANGLE.
Operation CEREBELLAR EXPLORATORY. Time Begun 2.30 P.M.
Preanesthetic Hypnotic NEMBUTAL Dose gr. 1½ Time of Admin 1.0 P.M.
Anesthetic ETHOCAINE Total Quantity — Technic LOCAL.
TIME 2 15 30 45 3 15 30 45 4 15 30 45 5
BLOOD PRESSURES
PULSE
RESP.
Rebreathing Tidal
OXYGEN %
REMARKS
PREOPERATIVE READINGS
LOCAL INJECTED, 2.30. PORTIONS, gr. ½, GIVEN.
OPERATION BEGUN, 2.37
RATHER CYANOTIC, 2.45
HEAD REPOSITIONED: BETTER.
TREPHINING, 3.0
POSTURAL ASPHYXIA: TUNG
DEEP-PRESSURE: RAPIDLY
OXYGEN GIVEN — NO AMEL.
VASOMOTORS: PULSE NEAR
IRREGULAR.
RE-POSITIONED: PHARYNGEAL
AIRWAY INSERTED: OXYGEN
COMMENCING RECOVERY.
PARTLY CONSCIOUS BY 4.5
CIRCULATION LEFT BADLY
DEPRESSED, SO NO ATTEMPT
MADE TO OPEN DURA.
WOUND CLOSED: OPERATION
ENDS, 4.44
SEMI-CONSCIOUS, BUT
BLOOD-PRESSURE STILL LOW
Operative Complications Affecting Anesthetic or Convalescence RECOVERED FROM SHOCK: FOR RE-OPERATION LATER.
Degree Circ Depression During Operation 1st 2nd 3rd ✓ end 1st 2nd 3rd ✓

FIGURE VIII. Operation record: circulatory depression due to asphyxia. The notation is the same as that employed in other figures.

No. A.M. **Anesthetic Record** Age 23

Surgical Risk { A / B / C / D ✓ }

Sex F.

Wt. Average.

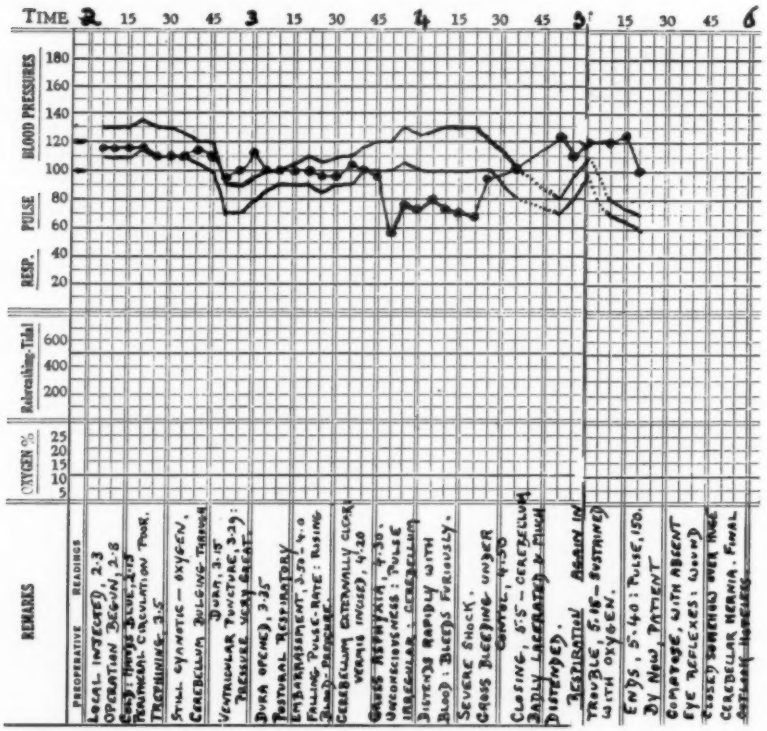
Physical Appearance, General _____ Facial Expression _____

Physical Conditions normal except UNLOCALISED TUMOUR, ? CEREBELLAR. VERY HIGH CEREBRAL TENSION.

Operation CEREBELLAR EXPLORATORY. Time Begun 2·3 P.M.

Preanesthetic Hypnotic MORPH: HYOSC. Dose ⅙ : 1/150. Time of Admin 1 P.M.

Anesthetic ETHOCAINE. Total Quantity ? Technic LOCAL.



Operative Complications Affecting Anesthetic or Convalescence. DIED 2 HOURS AFTER OPERATION. AUTOPSY SHOWED HUGE GROWTH-STHENOBLASTIC TUMOUR, WITH HAEMORRHAGE INTO IT.

Degree Circ Depression During Operation { 1st _____ / 2nd _____ / 3rd ✓ } end { 1st _____ / 2nd _____ / 3rd ✓ }

FIGURE IX. Operation record: postural asphyxia. The notation is the same as in previous figures.

of injection of the cocaine. Artificial respiration was maintained very effectually for a period of two and a half hours by endotracheal insufflation; the circulation, however, showed progressive deterioration and finally succumbed. The writer infers, then, that endotracheal insufflation may save life in cases in which a relatively intact respiratory centre is temporarily incapacitated by shock, cerebral interference or anæsthetic overdose, whereas injury capable of abolishing respiration for a prolonged period inflicts irremediable damage upon the respiratory and circulatory centres.

In the present series of cases, technical difficulties usually precluded laryngeal intubation once the operation had begun. Endotracheal anæsthesia, if employed, was therefore to be employed from the beginning. For this reason the endotracheal technique finally displaced local anæsthesia in this series as admitting of better control over the patient. Positive pressure apparatus was preferred as facilitating artificial respiration at need. Failing it, some measure of positive pressure may be secured from the conventional gas machine by rhythmic compression of the rebreathing bag between the anæsthetist's arm and side.

SOME TECHNICAL PROBLEMS IN CEREBRAL SURGERY.

Operations upon the Pituitary Gland.—Operations on the pituitary gland were not ordinarily found to produce much shock, especially the palliative transsphenoidal operation, for which ether anæsthesia was employed. The frontal approach to the pituitary fossa is a bigger procedure, but was found in general to give less anxiety and better final results than most major cerebral operations. Ether anæsthesia was used for robust subjects, unless contraindicated by the use of the diathermy apparatus. Gas anæsthesia is, of course, ideal. Patients with pituitary disease often present a low blood pressure, and this at times rendered the assessment of shock more difficult than usual. An operation record of this type is illustrated in Figure X. The case was one of removal of a pituitary tumour. The chart shows no abnormality other than the low blood pressure frequently found in pituitary disease, and persisting throughout the operation. Needless to say, the presence of a strong and regular pulse and of a dry, pink skin served to differentiate this form of low blood pressure from that encountered in shock.

Operations upon the Middle Cerebral Fossa.—Operations upon the parietal and temporal regions involved no special technical difficulties. Shock may be severe, so gas anæsthesia was preferred to ether.

Operations upon the Posterior Fossa.—Operations on the posterior fossa included operations for disease of the cerebellum, cerebello-pontine angle, brain stem and occipital lobe above the *tentorium cerebelli*. The prone position of the patients was unfavourable to respiration, and, as stated above, sudden postural respiratory embarrassment at times occurred. For these reasons, endotracheal gas anæsthesia was regarded as the technique of choice. Access to the posterior fossa and closure of the wound necessarily occupy a considerable time; operations upon

No. A.H.1258 **Anesthetic Record** Age 34

Surgical Risk: A ___ B ___ C ___ D ✓

Sex F

Wt. SMALL

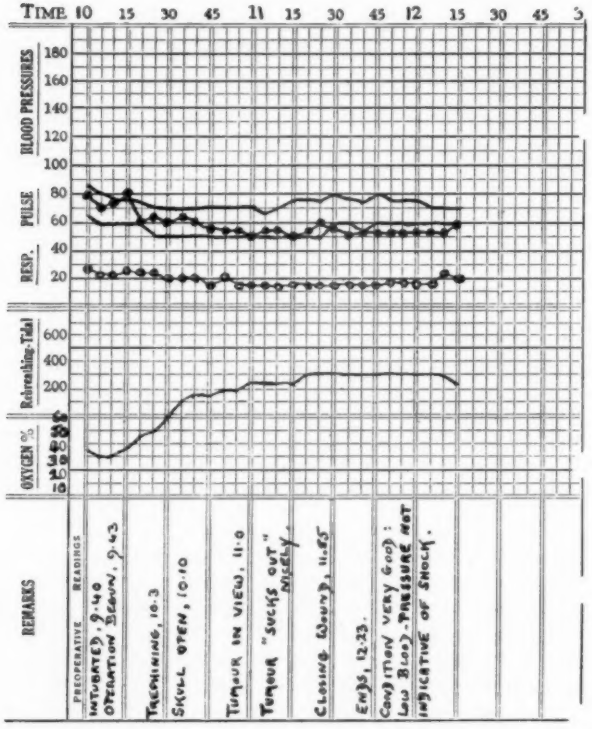
Physical Appearance, General ___ Facial Expression ___

Physical Conditions normal except SYNDROME OF PITUITARY ADENOMA. IS ALMOST BLIND. B.P. 80/60.

Operation PITUITARY TUMOUR. Time Begun 9.20 A.M.

Preanesthetic Hypnotic VERONAL & MORPH. Dose 7½ & ⅙. Time of Admin 7 A.M. & 10 A.M.

Anesthetic N_2O & O_2 Total Quantity — Technic ENDOTRACHEAL.



Operative Complications Affecting Anesthetic or Convalescence RATHER MUCH POST-ANAESTHETIC VOMITING; OTHERWISE VERY WELL.

Degree Circ Depression During Operation 1st ✓ 2nd ___ 3rd ___ end 1st ✓ 2nd ___ 3rd ___

FIGURE X. Operation record: low blood pressure in pituitary disease. The notation is the same as in previous figures.

this region were therefore found to be long, severe and attended by much hæmorrhage and shock.

Operations upon the Gasserian Ganglion.—Division of the sensory route of the Gasserian ganglion does not, in itself, imply much shock. Ether may therefore be used, unless contraindicated by the use of the diathermy apparatus or by the condition of the patient. Most of the patients in the present series were old and enfeebled, so that gas anæsthesia was chosen for them. The usual operating position was with the head and trunk raised from the table at an angle of some fifty degrees. This position minimizes bleeding and aids the access of the surgeon to the ganglion; it adds, however, to the strain upon the patient's cerebral circulation, especially if he be old. A material fall in blood pressure was accordingly observed in some cases, in which event the surgeon was requested to lower the head as soon, and as much, as was convenient. In connexion with the present series of cases a number of operations were performed for the injection of alcohol into the Gasserian ganglion; these minor procedures are not included in the table of operations set out in this paper. The patients being frequently old and feeble, gas anæsthesia was preferred. It has the further advantage of very speedy induction and recovery; the patient could thus be allowed to awaken after the injection of alcohol, could be tested for anæsthesia over the fifth nerve distribution, and, if necessary, could be reanæsthetized for a further injection. Endotracheal administration being unnecessary for so short a procedure, the technique adopted was to give the gas under positive pressure through the nose, as if for a minor dental operation. This allowed the surgeon reasonable access to the patient's face.

Operations upon the Spinal Cord.—Operations on the spinal cord are familiar in general as well as in neurological surgery. Endotracheal anæsthesia is necessary on account of the prone position of the patient. Exposure of the cord in the upper dorsal or cervical region is not very productive of shock, and ether anæsthesia may (*cæteris paribus*) suffice. Exposure in the dorso-lumbar region involves much hæmorrhage and laceration of tissue and a long operation; gas anæsthesia is therefore indicated.

Operations upon Children.—For obvious reasons, operations upon children should be performed under general anæsthesia or local anæsthesia combined with basal narcosis which has been carried to the point of producing oblivion. The former course was, in this series, preferred. Infants were found to resent endotracheal intubation and to suffer from an intense respiratory spasm as soon as it was performed. This spasm caused much anoxæmia and, even when overcome by the administration of oxygen under pressure, was apt to leave the circulation depressed. It is difficult to see, however, how the difficulty may be circumvented.

Children are difficult to maintain at an even plane of anæsthesia under nitrous oxide, but it may be done with care and with the possible

addition of a small amount of ether vapour at times when the diathermy apparatus is not in use. This course was found preferable to employing endotracheal ether anæsthesia. It was found that children had a definitely limited reserve of energy, so that whilst they stood the operation well for a certain time, they eventually became rapidly and seriously depressed. It was found well, therefore, when performing cerebral operations upon children, to endeavour to form from the start a clear picture of the desired objective and to attain it with all practicable speed.

The Closure of Scalp Wounds.—It generally happened that, before the time arrived to close the wound in a cerebral operation, the patient had suffered more or less from shock and had perhaps required a blood transfusion. During closure the patient's condition was again liable to deteriorate as a result of hæmorrhage from the vascular tissues of the scalp. Such hæmorrhage in a patient already debilitated was apt to have serious effects. The closure of the wound, therefore, came to be regarded as a final bridge to be crossed by the patient before reaching relative safety. Every effort was made to minimize bleeding whilst the scalp was sutured, since a surprising amount of blood could be lost from it if precautions were not taken. Rapidity of blood loss being even more potent in depressing the circulation than actual quantity lost, precautions against hæmorrhage were found to justify themselves. A further transfusion of blood was at times required during or immediately after closure of the scalp wound to compensate for loss of blood suffered in this way.

SOME NOTES ON POST-OPERATIVE CARE.

The moving of a badly shocked patient back to bed is fraught with risk. The shocked patient was, therefore, made as comfortable as possible upon the operating table, with pillows, blankets, hot water bottles and hot drinks. He was so left, even for several hours, until his circulation showed recovery. Morphine was given for pain and restlessness, but with caution in the presence of a very low blood pressure. Brandy was sometimes useful, less as a stimulant than as a means of producing mild euphoria. Return to bed was allowed only when the blood pressure had returned to ninety millimetres of mercury and the pulse was of good volume. To attain this degree of recovery, a further infusion of saline solution or of blood was sometimes necessary.

The after-care then became the province of the surgeon rather than of the anæsthetist. The latter visited the patient, however, within the next twenty-four hours, so that undue post-anæsthetic vomiting or respiratory sequelæ might receive attention. Severe vomiting seemed to be unusual after cerebral operations. Excluding patients suffering from vomiting of cerebral origin before operation, post-operative vomiting was recorded as wholly absent in three out of seven patients

in this series who received ether, and in fifteen out of twenty-three patients who received gas.

Respiratory sequelæ were likewise rare in this series. No case of bronchitis or pneumonia occurred after general anæsthesia, although fatal post-operative pneumonia occurred in one patient who had undergone cerebral exploration under a local anæsthetic. Some measure of laryngo-tracheal irritation was observed in several cases, although it was perhaps surprising that the incidence was not higher when it is recalled that an endotracheal catheter was left *in situ* for hours at a time. Tracheitis was observed in one patient after endotracheal ether anæsthesia. Another patient suffered from sore throat, due probably to some measure of hypopharyngeal trauma caused at intubation under gas, the intubation being made difficult by abnormal configuration of the jaws. Definite laryngitis occurred in two patients, but there was reason to suspect that it had a chemical origin, the catheters being inadequately cleansed of antiseptic before being handed to the anæsthetist. For this reason the use of carbolic acid as an antiseptic for catheters was discontinued and biniodide of mercury was substituted. The latter is more readily rinsed from the catheters than is carbolic acid, and is in any event less caustic.

The anæsthetist was equipped with the necessary appliances for the administration of carbon dioxide and oxygen mixtures to patients threatened with respiratory sequelæ. He was also called upon to carry out oxygen therapy in cases of cardio-respiratory depression of central origin and of hyperthermia. It cannot be said that any permanent benefit resulted from oxygen therapy in these two conditions.

SUMMARY.

1. The present paper consists of observations made from the anæsthetist's angle in seventy-seven operations upon the brain or spinal cord.

2. These operations have been classified in terms of the site of the lesion, the anæsthetic technique employed and the operative mortality.

3. Of the sixty-three patients concerned in the present report, four (6·4%) succumbed during operation and fourteen (22·2%) during the post-operative period. The remaining forty-five were well when they left hospital, although not necessarily benefited by operation.

4. Details are given of four fatalities on the operating table.

5. The duties of the anæsthetist are discussed in terms of pre-operative examination of the patient, administration of the anæsthetic, keeping of the operation record and combating of shock.

6. The anæsthetist's equipment is detailed.

7. The scope of certain anæsthetic methods (local, local with inhalational supplement, endotracheal use of ether, and endotracheal use of nitrous oxide) is discussed, together with notes on pre-operative sedation in each group.

8. Detailed consideration is given to the apparent causes and to the treatment of shock and respiratory embarrassment during cerebral operations, and in particular to the rôle of the anæsthetist in aiding such treatment.

9. Some technical problems due to the site and character of certain cerebral operations are discussed, and the post-operative care of patients is considered so far as this lies within the province of the anæsthetist.

ACKNOWLEDGEMENT.

The writer desires to express his thanks to H. C. Trumble, F.R.C.S., chief of the neurosurgical unit in the Alfred Hospital, Melbourne, upon whose patients most of the observations forming the basis of the present paper were made.

GAS KERATITIS.[1]

By W. A. FAIRCLOUGH,
Auckland.

MUSTARD gas or dichlor-ethyl sulphide was the most potent and destructive of the various poison gases used in the 1914-1918 war.

The choking gases generally had a chlorine basis and the tear gases a bromine or iodine base. The formula of mustard gas[1] is $(CH_2CL\ CH_2)_2S$. The exact corrosive formed when it combines with the tissue fluids is not known, but it is something more destructive and subtle in its action than hydrochloric acid.

Among the many thousands of wounded and disabled whom we carried across the channel from France to Southampton, I remember a certain number of men with inflamed eyes, but the connexion of the inflammation with gas exposure was not then recognized as being of particular importance. Subsequent events, however, have established these eye burns as a definite entity.

Reginald Bickerton, of St. Dunstan's Hospital,[2] reports men exposed to gas in the war who have come under the institution's care quite recently. They had become blinded as the final result of exposure to shell and cloud mustard gas seventeen years previously. These men, in spite of treatment, had undergone years of suffering and incapacity, with progressive loss of vision leading to blindness. The effect of chlorine gas and of the various tear gases passes off fairly soon. Mustard gas, on the other hand, has the most damaging and permanent effects on the conjunctiva and cornea, and on occasions it has been associated with deeper changes in the eye, such as retinitis and night blindness. These deeper defects have also followed exposure to phosgene gas. After exposure to dichlor-ethyl sulphide, a conjunctivitis of varying severity is set up, and it is generally followed by a prolonged period of treatment.[3] Sometimes corneal œdema or ulceration is actually present at the time of trauma. Usually, however, the conjunctiva only is affected. The effects of the original trauma, as a rule, subside, and corneal ulceration occurs later. However, between the original injury and the onset of corneal trouble there may not be a period of freedom from irritation. The disease may simply be continuous from the time of injury. This latter type is not the condition with which I am concerned at present, because the cause is obvious. It is rather the delayed action type that

[1] Read at the annual meeting of the Royal Australasian College of Surgeons, Auckland, January, 1937.

I speak of, in which there is a possibility of the real and original cause being overlooked.

Both corneæ are generally affected, but not commonly at the same time. Years may elapse before the second eye is subject to this form of keratitis. In a typical case the lids may show little change, the palpebral conjunctiva may be congested in varying degree, from moderate to severe. The bulbar conjunctiva may have prominent large vessels giving rise to a marbling appearance. Scarring of the conjunctiva may or may not be present; and this is characterized by pearly grey areas usually devoid of vessels.

The corneal ulceration may sometimes be shallow, sometimes deep, varying in site from the centre to the limbus. The resulting scars may be irregular, with some of the edges heaped up, and in places what appears to be calcification may be present. An appearance like an *arcus senilis* is often present. Tactile sensibility of the cornea is frequently impaired or absent.

A prominent feature in the condition is the slow healing of the ulcers and the frequency of recurrence, leading ultimately in most cases to total loss of vision. Photophobia and lachrymation are two practically constant symptoms in the disease. I know of three patients with gas keratitis in this country, and two of them who have been in my care for some years are here today for you to examine. A brief history of each of these men follows:

CASE I.—F.H. had normal sight on enlistment in 1916. In 1917 he was exposed to mustard gas at Passchendaele. He was treated in several hospitals; the condition of his eyes improved, though a month after the trauma he was reported as having corneal nebulæ in both eyes. Improvement continued, and he was passed as fit for active service early in 1919. No claim was made for a pension at the time of his discharge.

The patient carried on full-time work for some years. Then in 1930 his eyes began to trouble him again. Photophobia and lachrymation became more troublesome, and he attended hospital with shallow ulcerative keratitis. Under treatment his condition improved and he resumed work.

In 1936 the symptoms and ulceration had recurred at varying intervals during the previous six years, and off and on he had been totally incapacitated. The vision of the right eye was $^{6}/_{60}$ and of the left $^{6}/_{18}$; and he complained of constant dazzling to light and of watering eyes. The lids appeared to be normal. The conjunctiva showed some enlarged vessels, but no scarring. The corneal surface was covered by epithelium, but the whole area was nebulous and facetted, except on an upper crescent, which is protected by the lid. Some of the nebulous streakings have an appearance which suggests calcification. Corneal sensation is reduced in the right eye. The fundus was visible in a distorted way through the clearer part of the cornea. No gross lesion could be seen. The patient was clear of symptoms for about ten years.

CASE II.—In 1918 J.S. was exposed to mustard gas. He was in hospital with conjunctivitis and keratitis for 63 days. He made a fairly good recovery. In 1919 his eyes were well and he had no complaint. In 1924 his eyes began to trouble him again, and he has been under treatment off and on ever since. A period of five years of comparative ease and good vision was enjoyed between the original trauma and the final breakdown.

In 1934 vision of the right eye was $^{6}/_{36}$ and of the left eye $^{6}/_{60}$.

In 1936 vision of both eyes was less than $^{6}/_{60}$.

The patient has been learning Braille and typing at the New Zealand Institute for the Blind.

The lids present no particular change; slight conjunctivitis exists, but no visible scarring. He has photophobia and lachrymation and partial corneal anæsthesia. The cornea is more or less transparent above and below where it is protected by the lids. The transverse exposed area is nebulous and facetted with a watered silk effect in places. The epithelium is heaped up in spots, and calcareous-looking streaks are plainly visible. There is evidence of past iritis, right and left. The fundus can be faintly seen through the upper clear area of the cornea. No gross lesion is visible.

Slit lamp examination of the cornea shows very clearly the changes mentioned in these cases.

The patient had a clear period of five years between the gas trauma and the onset of the keratitis.

CASE III.—J.G. was exposed to mustard gas in 1917[4] He sustained eye injury and body burns. The conjunctivitis, blepharitis, œdema and photophobia were severe at the time of injury. He made a fairly good recovery, and in 1920 was a tram conductor. The vision in both eyes was $^6/_9$ with glasses.

In 1923 a left corneal ulcer developed and healed. From this date ulceration recurred repeatedly until 1936, when the blind painful eye with a calcareous condition of the cornea was removed.

In 1933 the right eye was first mentioned as giving trouble, that is, sixteen years after the first trauma. With the subsequent history of this second eye I am not acquainted. He had a clear period of five years with the left eye and of sixteen years with the right eye.

Although gas keratitis is a condition not frequently met with at present, it is probable that it will be all too common if the great European powers go to war again.

In the way of treatment we have nothing of outstanding value to offer. Protection of the eyes from glare and from minor traumata and the use of mydriatics and mild collyria and guttæ have eventually brought about healing of the corneal ulcers.

From my experience of the condition I conclude that the light application of phenol does not have the usual effect in stimulating healing.

These unfortunate men have periods of comparative comfort between the active attacks of ulceration, but they are quite unable to follow or remain in a permanent occupation, and an important part of our treatment is carried out when we see that the condition is recognized as a war disability. The possible interval of comparative comfort between the gas exposure and the first step to final blindness should not obscure the diagnosis.

SUMMARY OF ESSENTIALS.

1. Exposure to mustard gas is probably followed by prolonged treatment.

2. There is not necessarily, but there may be a period amounting to years of freedom from symptoms.

3. Photophobia and lachrymation are very constant.

4. The lids are not necessarily affected.

5. In the conjunctiva some congestion is common; scarring is occasional.

6. In the cornea shallow or deep ulcers occur; these are slow to heal and recur. The cornea has irregular scars and facets, calcification streaks and diminished sensibility.

REFERENCES.

(1) Captain W. G. Gentry, Staff Officer, Engineers, New Zealand Military Forces: Personal communication.

(2) Reginald E. Bickerton: "New Cases of War Blindness due to Mustard Gas", *The British Medical Journal*, October 27, 1934, page 769.

(3) Memorandum from the Ministry of Pensions, London, to the New Zealand Government, 1936.

(4) New Zealand War Pensions Department.

Surgical Technique.

STEAM SUCTION APPARATUS FOR SURGERY.

By GERALD DOYLE,
Honorary Physician to Out-Patients, Saint Vincent's Hospital, Melbourne.

THREE years ago the use of the steam ejector as a means of providing suction for surgical purposes was described by me in *The Medical Journal of Australia* of May 5, 1933. Since that date the ejector has been installed in several metropolitan hospitals. The following notes are submitted with a view to assisting any surgeon who may be interested in installing one.

FIGURE I. The most recent style of receptacle. The bottle is made by Fowler's Vacola Company, and replacements can be had if required.

First a good steam pressure is necessary. In most operating theatres sterilizing is done at a pressure of 25 to 30 pounds per square inch. This pressure is ample. If further power is needed, the steam can be taken off the line before it enters the reducing valve, at a pressure of 50 to 70 pounds to the square inch.

As this pressure gives enormous suction, it is wise to have a safety blow once a specified vacuum is reached.

The steam ejector can be bought at any hardware store. Various makes are used, British and American. The hospital engineer will have no difficulty in selecting a suitable size, which is generally half an inch. As there has to be a steam outlet, care must be taken to see that it passes in a straight or slightly curved line to the drain where it empties. It is important to see that this is on the ground, otherwise when steam has been off for a time, the pipe is full of water and may cause trouble. If the theatre is not on the ground floor the outlet pipe is taken to the roof. A means of escape for water of condensation is allowed for.

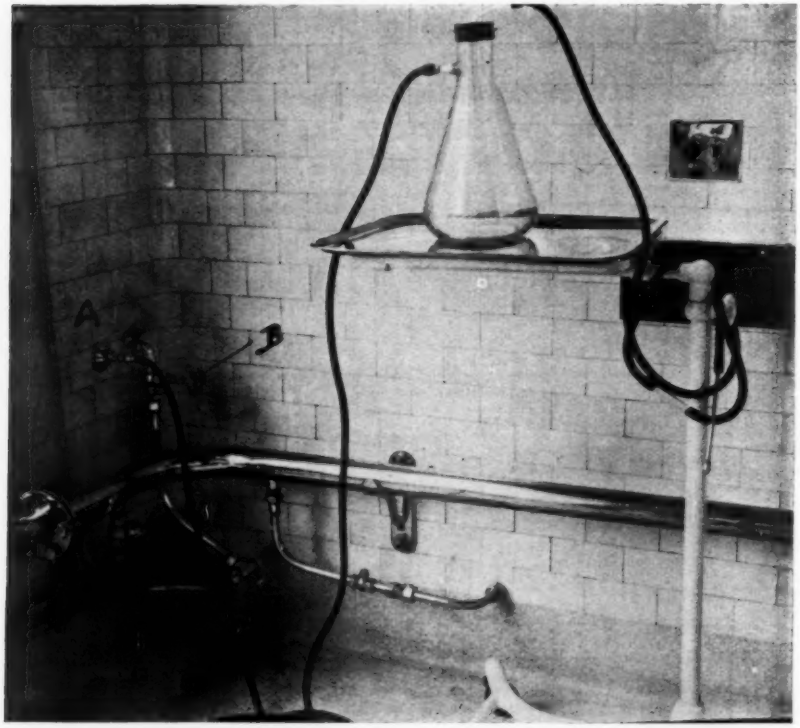


FIGURE II. A recent installation, showing the hose connected at A to the intake. The steam control (B) can be seen. The fittings harmonize with the plumbing.

The tank described in the original article is now superseded by a large Fowler's "Vacola" jar with a cap to clamp on. In none of the later installations has the original idea of having a special line from the suction bottle for the anæsthetist been copied. I am sure that any anæsthetist having had one at his disposal would never give an anæsthetic without one. Taps must be avoided, as they decrease the bore of the intake and lead to blocking. The tube should be left open and fitted with a cap. If this has a rubber lining, the suction will hold it firmly in place when the power is on. In some installations a vacuum gauge has been installed, but this is an unnecessary innovation, unless the high pressure steam is used.

If the vacuum bottle is large enough, the tank as described in my original article is unnecessary.

All that need be seen are a small tap in the theatre and a nozzle to put on the rubber tubing. The plumbing can be made to harmonize with the general plumbing fittings in the hospital.

Plumbing costs in the city are apparently higher than in the country, as the original estimate quoted has been exceeded on every occasion. The task of installing one is not beyond the ability of any hospital engineer.

There is no doubt as to the efficacy of this pump. Once it is installed, there are no repairs and no maintenance charges, and the actual working expenses are infinitesimal. When it is not working it costs nothing.

Photographs are supplied showing the type of "Vacola" bottle used and the general appearance of one of the recent installations.

Case Reports.

FRACTURE-DISLOCATION OF CERVICAL VERTEBRÆ.

By JOHN HOETS,

Sydney.

A.B., AGED two years, was playing in the back yard with an empty oil drum. His mother went inside for a time, and on coming out again found the little boy standing quietly crying with his head flexed on his chest as shown in Figures I and IA. He was too young to give any coherent account of what had occurred, but it was surmised that the oil drum had rolled over when he was leaning on it and he had been up-ended and turned completely heels over head.

FIGURE I.

FIGURE IA.

Strange as it may seem, no steps were taken to give the child medical attention for nearly twelve months, during the whole of which time the parents, apparently unmoved, saw the child, day after day, and week after week, in the condition in which he finally came under observation.

The report on the skiagram (Figure IA) was as follows: "There is considerable disorganization of bodies of third and fourth cervical vertebræ, with angular kyphosis at this level. The second is displaced anteriorly on the third. The appearance suggests a fairly long-standing condition, possibly traumatic, possibly inflammatory."

The child was admitted to Sydney Hospital on December 21, 1935, and is still an inmate of the children's ward. In spite of the apparent severe kinking there were no signs of cord lesion. From the time of the child's admission to hospital the general condition began to improve, and he is now as happy as the

FIGURE II.

FIGURE IIA.

FIGURE III.

FIGURE IIIA.

day is long. There has been no sign of inflammatory change, such as swelling or undue tenderness, and the temperature and pulse have remained within normal limits throughout.

Treatment has been by the application of collars of gradually increasing height in front, at first of padded metal with chin and chest piece, and later plaster of Paris. A celluloid collar is now being made, so that it may be removed for cleansing both the celluloid and the skin.

The illustrations show the gradual improvement in the posture of the head, partly by some improvement in the position of the affected vertebræ, and partly by the development of secondary curves above and below the actual site of the lesion.

Comment.

The most striking feature is the almost incredible lack of ordinary care on the parents' part. No doctor saw the child for twelve months from the time of the supposed accident.

The diagnosis of fracture-dislocation of purely traumatic nature must be open to doubt. Without some preliminary softening of the tissues by inflammation (for example, spinal caries) one can hardly imagine trauma in the circumstances described producing such a result.

The last skiagram suggests definite buiding up of the vertebral bodies.

ANGIOMA OF CEREBRUM.

By T. Y. Nelson,

Sydney.

The occurrence of vascular anomalies in the brain and their association with cutaneous nævi, especially in the distribution of the fifth cranial nerve, have been recognized and described in the literature, but the clinical picture associated with changes in their structure may cause errors in diagnosis if these lesions are not borne in mind.

Venous angiomata or venous anomalies as described by Dandy[1] may be present for many years without giving rise to symptoms, and in a series of seven cases the age of onset of convulsions, which may be the first sign of their presence, varied from five months to twenty-eight years.

Frequently the first indication of the presence of such a condition is an acute illness which is diagnosed as "encephalitis", and from which the patient may completely recover; this history was obtained in four of eight cases described by Wolf and Brock.[2]

The natural process of cure would appear to be calcification in the constituent vessels, and it is quite common for these calcified areas to be seen in radiographs of the skull, their appearance being suggestive of the presence of such a lesion when the other facts of the case are taken into account.

Clinical History.

A girl, aged ten years, was admitted to hospital with the history of a sudden illness occurring two days previously, in which the child complained of pain in the left eye, intense headache and vomiting. She rapidly became unconscious and was admitted to hospital in a semi-comatose condition, covered in sweat, with a rapid pulse-rate and loss of control of sphincters. A history was obtained from the mother that two years previously there had been a convulsive attack in which twitching of the right arm and leg had occurred, but the child had recovered in two days and had been perfectly well since.

As a tentative diagnosis of encephalitis had been made, lumbar puncture was performed and showed that there was no increase in pressure of the cerebrospinal fluid and no macroscopic evidence of blood. Microscopic examination revealed only four cells per cubic millimetre and there was no other abnormality.

The child's condition improved, and later examination revealed paralysis of the right side of the face, arm and leg, with diminution of sensation, especially in the arm. The left disk showed 1·5 diopters of swelling and the right disk was blurred, but a week later well marked neuritis was present on both sides. Radiographic examination of the skull revealed an area of irregular calcification in the left cerebrum appearing just below the coronal suture.

When the child's condition had improved enough for her to move about, encephalography was performed, and injection of twenty cubic centimetres of air was sufficient to display the ventricular system and the cortical pathways. It was then noted that the ventricles were not displaced laterally, and there was no air to be seen over the area of calcification seen in the previous radiograph. This was sufficient evidence to exclude a space-occupying lesion of the cerebrum, and a diagnosis of angioma was made.

The child's condition continued to improve, and eventually she recovered full use of the arm, but was left with facial weakness and some rigidity of the right leg, with plantar flexion deformity of the right foot.

Later an exploratory craniotomy was performed, the left Rolandic fissure being exposed. The dura was adherent to the underlying tissues, but could be gently separated without hæmorrhage. An angiomatous collection of blood vessels was displayed on the surface of the brain and a calcified area could be seen at the periphery. The sulci in the affected area showed the gelatinous milky appearance associated with chronic arachnoiditis. It was possible to ligate with a silk suture three of the vessels at the periphery of the mass, and the dura and flap were then closed in the usual way.

Recovery was uneventful, and a few days later it was noted that the facial weakness had disappeared, and there was less spasticity of the right leg, although these signs were again apparent at a later date.

Comment.

This case illustrates the acute cerebral attack which has been described as being due to some sudden alteration in the circulation of the tumour, either by the introduction of an arterial element into a previously venous lesion or by the occurrence of hæmorrhage. The child had no cutaneous nævi to suggest the intracranial condition, nor was there any underlying maldevelopment of the cortex with mental deficiency, as described in Dandy's cases. The occurrence of papillœdema has not been a common feature of the recorded cases, but was probably due in this instance to a general increase in intracranial pressure. Unfortunately, manometric readings were not taken at the time of lumbar puncture.

The treatment of these conditions varies with the extent and density of the network of vessels, and although ligation of some of the entering vessels might appear sufficient in the simpler cases, ligature of the common carotid artery has been recommended for the more extensive conditions.[3] Sachs[4] has described a method of thrombosing the constituent vessels by the use of a very weak coagulating current, the electrode being gently stroked over the vessels without perforating them. Finally, the efficacy of deep X ray therapy in the more vascular arterio-venous aneurysms suggests that this form of therapy might be of use in the conditions under discussion.

References.

[1] Dandy: "Venous Abnormalities and Angiomas of the Brain", *Archives of Surgery*, November, 1928, Volume xvii, page 715.

[2] Wolf and Brock: "Pathology of Cerebral Angiomas", *Bulletin of the Neurological Institute of New York*, February, 1935.

[3] Rogers: "Associated Facial and Intracranial Hæmangiomata", *The British Journal of Surgery*, Volume xxi, 1933-34, page 229.

[4] Sachs: *Southern Medical Journal*, Volume xxv, October, 1932, page 1013.

HYPERADRENALISM.

By KENNETH MACKENZIE,
Auckland.

A FEMALE patient, aged sixteen years, gave a history that menstruation had commenced at the age of thirteen. It was always very scanty and irregular, often with intervals of two to three months. With the onset of menstruation hair began to grow on her face, at first in front of the ears, then spreading round beneath the chin. The complexion became bad, with multiple pigmented spots on

FIGURE I.

FIGURE II.

the face and on the exposed part of the chest. The hair growth increased greatly in the last few months, and there was a beard with hairs two inches long. Her weight increased fairly rapidly after puberty, and at the age of sixteen was 74·25 kilograms (eleven stone eleven pounds) for a height of 157·5 centimetres (five feet three inches).

Examination revealed a well grown girl, with obesity, particularly of the chest and abdomen, the thickening being most pronounced across the shoulders. The skin of the flanks showed many colourless striæ. There was no muscular weakness. The breasts were well developed. There was nothing abnormal about the external genitalia. The facial condition is shown in Figures I and II. There was no undue growth of hair in any other parts of the body, but the pubic hair had a masculine distribution. No abdominal tumour could be felt. Pyelograms showed the kidneys to be in normal position. Radiograms of the skull revealed

no enlargement of the *sella turcica*. The basal metabolic rate was −4·7%, the systolic blood pressure 130 and the diastolic pressure 90 millimetres of mercury.

On February 6, 1936, a right lumbar incision was made. The peritoneum was opened and the abdominal organs were examined. The uterus was very small; the ovaries were of normal size. There was no tumour in the left renal region. The right adrenal gland was exposed; its size was within normal limits. A thickening was felt in the lower part and about half of the gland was removed. Section showed normal adrenal tissue. On February 24, 1936, operation was performed on the left side. The adrenal was enlarged to about double the normal size. Two-thirds of the gland were resected. The microscopic report was that the whole cortex was enlarged, but that the change was very striking in the outer cortical layer, the *zona glomerulosa*. The cells of the various layers appeared normal. There was no tumour formation.

Two months after operation the patient had a menstrual period, much more abundant than formerly, and at the same time there was some falling out of the hair, which continued in small quantity for several weeks. It was not sufficient to make any appreciable difference to her appearance, and she resorted to daily shaving.

She is now in good health; her menstruation is regular and of about normal amount. She has lost 9·0 kilograms (twenty pounds) in weight. The blemishes on the skin of the face have largely disappeared.

The clinical features of this case justified a diagnosis of hyperadrenalinism, and had an adrenal adenoma been found an excellent result could have been expected. The condition was not so simple as that, and the upshot is rather disappointing. It is certain that an overactivity of the adrenal cortical hormone was a main factor in the disease, if not the only one. It is possible that the pituitary was also playing a part. There is as yet little guiding information as to the possibilities and limitations of partial adrenalectomy in cases of hypersecretion not proceeding from adenoma.

The Australian and New Zealand Journal of Surgery.

All articles submitted for publication in this journal must be typewritten and double or treble spacing should be used. Each article should conclude with a brief summary and statement of conclusions. Authors are requested to avoid the use of abbreviations and not to underline either words or phrases.

References to articles and books should be carefully checked. In a reference the following information should be given without any abbreviation: Initials of author, surname of author, full title of article, name of journal, volume, full date (month, day and year), number of the first page of the article. If a reference is made to an abstract of a paper, the name of the original journal together with that of the journal in which the abstract has appeared, should be given, with full date in each instance.

When illustrations are required, good photographic prints on glossy gaslight paper should be submitted. Line drawings, charts, graphs and so forth should be drawn on thick white paper in India ink. Authors who are not accustomed to prepare drawings of this kind, are invited to seek the advice of the Editor if they are in any doubt as to the correct procedure. Skiagrams can be reproduced satisfactorily only if good prints or negatives are available.

VOL. VII. OCTOBER, 1937. No. 2.

THE COMPLETE SURGEON.

In the January, 1937, number of this journal Sir D'Arcy Power published an illuminating article on "The Cultured Surgeon", in which he stated that the era of the cultivated surgeon, as we judge him by modern standards, began with Sir Benjamin Brodie (1783 to 1862).

Since Brodie's time physicians rather more than surgeons have been distinguished for culture, perhaps because the former, in Baconian phrase, can more often ramble through the wide and pleasant fields of generality and forsake the enclosures of particularity. It cannot be denied that one of the early fathers of scientific surgery, John Hunter, said that a good carpenter could be taught to operate. The truth is clear: a surgeon without general culture is little more than a technician.

The recreations of a surgeon should be outdoor exercise for physical health, and, for mental development, general reading, conference (which, being interpreted, means discussion), and writing, for "reading maketh a full man, conference a ready man, and writing

an exact man". Apart, however, from a wide and general culture which should belong to all liberal and learned professions, there is scope for culture for the surgeon within the practice of his own science and art. This may be called internal culture, not as opposed to external culture, but complementary to it. The whole aim of surgery is surely something more than the treatment of local disease by manipulative and instrumental methods, the cutting away of diseased parts and of substances foreign to the human body. Removal of what cannot be cured is a confession of failure made by the surgeon, vicariously perhaps for the physician.

Operative surgery, based on ancillary sciences and on sound surgical principles and applied only when necessary in suitable cases, has given generally such magnificent results that the operation *per se* is apt to outshine all else in the field of vision. Young surgeons in particular must strive to see the picture of a surgical case in its true perspective, that is, in just proportion in all its parts. The patient, of course, is impressed by the operation and nothing but the operation, and knows little of the surgeon's anxious care and toil of thought both before and after the dramatic scene in the operating theatre. There are patients who rebel against surgical operation, but the great majority are ready and indeed eager for the sacrifice as a short cut to health. There is in the distressed human mind an urge for violent action, "and without shedding of blood is no remission". Generally the urge is rewarded, sometimes it leads to vain effort and disappointment, and sometimes improvement following operation is due mainly to medical treatment.

The "Surgeon's Vade Mecum", published in London in 1843, is a valuable and a candid book, for it makes the most of both worlds, surgical and medical, and provides long lists of valuable prescriptions for the complications of surgical cases. Operations for peptic ulceration may remove the symptoms, but will these operations prevent further ulcer formation and other attendant risks if the patient is allowed to resume his old life in the old way? In some clinics, patients, after partial gastrectomy or gastrojejunostomy, are kept to a strict regimen for the space of two years; in other clinics these patients, after the wound is healed, are merely cast adrift cured.

Professor Houston has recently reminded the medical profession that all patients come in a state of fear to the doctor, and need to be treated as psychoneurotic problems. They want a dogmatism, when the most they can reasonably expect in the mind of a medical adviser is

a high degree of probability. Even the scientific accuracy of a radiograph needs interpretation and leaves a margin of error.

That the practice of medicine has changed is evident to everyone. It is not here necessary to discuss the advantages of specialization or the dangers of too narrow an outlook in specialization. It can boldly be affirmed that the special practice of general surgery can be advantageously divided up into various sections. Purely surgical knowledge alone is not enough. Neither are lingering and blurred memories drawn from the curriculum sufficient, nor intensive post-graduate study if maintained on lines strictly surgical.

It is the policy of the Royal Australasian College of Surgeons to insist that its Fellows shall have been trained in a system called, for the want of a better name, apprenticeship; and young men of promise are to be encouraged after graduation to take hospital appointments as associates in surgery. It will generally be agreed that some experience in general work is desirable for all who wish to adopt exclusively the practice of surgery. This may be necessary if only for financial reasons, although there is now a movement to provide honoraria for the visiting staffs of public hospitals. Surgical associates may be restricted in their work to surgical wards and surgical out-patient departments, but this writer pleads for a wider education or, rather, culture, for culture is more than mere education.

The system at the Mayo Clinic has much to commend it, and has been successful for about twenty years. It may not be strictly applicable, either in whole or in part, to Australia and New Zealand, but it will serve to illustrate important principles. Young men called Fellows (but the word is not used in the sense in which we use it), or as we would say, surgical associates, are selected from many applicants on a competitive basis. They must have to their credit at least one year of acceptable post-graduate hospital or laboratory training. Their minimal period of residence after selection is three years, and the average is four years. These young surgeons must give nine months to laboratory work in surgical and experimental pathology. They devote fifteen months to diagnostic work. They have one year of second assistantship, and later one year of first assistantship in operative surgery. They are trained also in surgical pathology by routine examination of gross specimens from the operating theatre and of frozen sections taken from these specimens. They learn much from intimate daily contact with their seniors in various departments. They learn more from discussions than from books and formal lectures: the

curse of Æsculapius on any high priest of our cult who dares taboo discussion! A high standard of knowledge of anatomy is required, and sound knowledge also of physiology, biological chemistry and pathology which underlie diagnosis.

These embryo surgeons do not begin work in the operating theatre until they have been two years in residence. "It is the opinion of the faculty that early operative work tends to concentrate attention on this phase of surgery to the disparagement of diagnosis and the fundamentals underlying both diagnosis and treatment." The wider culture of the surgeon demands a superior knowledge of all the basic medical sciences supporting the practice of surgery, and essential for skill in diagnosis as well as in treatment.

The late E. Starr Judd believed that the complete surgeon required, moreover, some knowledge of philosophy or logic in so far as it relates to ideal methods of thought and research; æsthetics for craftsmanship and artistry; ethics for ideal conduct; and medical politics as far as our custody of health in the social organization is concerned.

JAMES ELLIOTT.

Surgery in Other Countries.

[In this column will be published short résumés of articles likely to be of practical value from Journals published in other countries and not readily accessible to surgeons in Australia and New Zealand.]

Sectional Radiography.

R. Janker: "*Das Roentgenschichtverfahren*", *Zentralblatt für Chirurgie*, Volume lxiv, Number 14, April, 1937, page 3. (Department: *Fortschritte der Chirurgie*, pages 826 to 861.)

The method of sectional radiography (*Roentgenschichtverfahren*), known as planigraphy, tomography, stratigraphy *et cetera*, though undoubtedly one of the most remarkable advances ever made in radiology, is as yet little known in this part of the world. In a long and very interesting paper, Janker, after reviewing briefly the principle of the method and the results obtained thereby so far by others (notably Chaoul), discusses the possibilities of planigraphy with special reference to the skeleton. A large number of X ray films reproduced in the text are a striking illustration of the achievements of the new method.

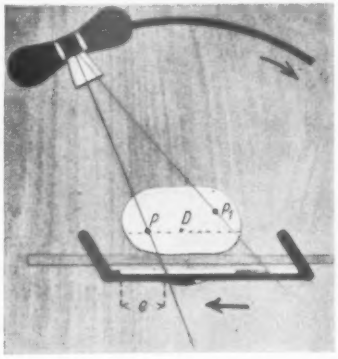


Figure I.

The fundamental principle of planigraphy is a simultaneously moving X ray tube and photographic cassette (or fluorescent screen) in opposite directions, the effect being that the X ray shadows from all parts in the patient's body are "blurred away" but for those originating from parts in one definite stratum. The only sharp part of the object on the X ray film or screen is that in the plane of the axis of rotation of the moving X rays. The rest of the ordinary confusing shadows from the remainder of the object are blurred or veiled because they are moving as the X ray film is being exposed, but the sharp plane is stationary, relative to the corresponding movements between the X ray tube and cassette (see Figure I). Every point on plane P is unblurred on the film because each is in the axis of rotation of X rays, but in plane P1, for example, all parts are blurred. Any one thin stratum of the patient's body can thus be examined radiographically without interference by intervening objects. The layers so examined are remarkably thin. For example, various planes of the carpal concavity are shown, and at 3·5 centimetres above the table top all bones are shown except the *multangulum majus*. The exposure is chosen so that it is sufficient for a picture of one spot to be taken, and the line which results from the movement of this spot during the exposure will be drawn out as a faded unexposed line. Such respective dots are reproduced as a gossamer veil. By altering the distance of X ray tube (or the patient) from cassette the plane of rotation, and therefore the plane which is cut, is altered. A particular plane which it is desired to cut is found by trial and error or by measurement. Conversely, foreign bodies can be exactly localized by measurement from the surface.

How certain shadows in a skiagram can be "blurred away" by movement is perhaps easiest understood by referring to the technique of Ottonello and

Pelissier. On a normal postero-anterior skiagram of the head the upper cervical vertebræ are hidden by the shadow of the lower jaw. However, if the patient opens and closes his mouth several times while the exposure is made, the shadow of the lower jaw is spread evenly over a larger area and thus "blurred away", and all cervical vertebræ are distinctly visible, especially the atlas.

Various principles have been tried or suggested for the movement of the tube. Janker shows that the movement along the longitudinal axis of the patient—first introduced by Grossmann—is not always desirable, and a lateral shift may be required. A similar view had been held by Ziedses des Plantes, who is amongst the earliest pioneers of planigraphy and whose apparatus provided for a spiral movement of the X ray tube; furthermore, by rotating the patient, planes in any direction whatever may be investigated.

In order to judge the actual value of the new method it is not sufficient to compare it with ordinary radiography, and all refined techniques should also be taken into account, such as: fluoroscopy under oblique angles, aimed snapshots, antero-posterior instead of postero-anterior direction for examination of the lungs, the application of Bucky diaphragms or opaque media for the study of the lungs, stereography, and particularly the contact method (in which the tube is brought right against the patient's body), which is really a simple variety of sectional X ray examination. Janker summarizes his experiences as follows:

FIGURE II.

FIGURE III.

"All these techniques were used, wherever possible, alongside with the planigraphic method. Great care was taken to compare only films of equally high standard and obtained by a faultless technique. It was found that the planigraphic method yields undoubtedly valuable results. For, while in some cases no further important details were revealed by the new method, there were quite many instances in which its superiority became apparent. But even in such cases where no new diagnostic details were obtained, the findings gained in objectivity, accuracy and distinctness.

"Though it is obviously quite impossible for a planigraphic film to contain any shadows which would not also exist in any ordinary skiagram, there are numerous cases in which planigraphy enables us to interpret correctly intersecting shadows and to notice minute differences in intensity which otherwise would have escaped observation.

"After comparing ordinary and planigraphic films we are naturally often surprised to find how many details can be seen in the ordinary skiagram, once we have learnt to recognize them.

"And this, I believe, is a point of very great importance: (i) there are certain observations which only planigraphy can teach us to make; (ii) it enables us to replace subjective impressions by accurate objective evidence; (iii) it shows distinctly the origin of the numerous intersecting shadows of the ordinary skiagram."

As a proof of the importance of the new method a number of cases are described, and in each of them the ordinary skiagrams are put against films taken by planigraphy.

The first case mentioned is a luxation of the carpal semilunar. The planigraphic film shows this bone to occupy the same plane as the hamulus and trapezium, but all the other carpal bones in the concavity of the carpal arch are "blurred away". This is an amazing exposition of the method, although a lateral X ray examination would, of course, demonstrate the dislocation.

For studying the internal structure of bones planigraphy is particularly valuable. Thus an ordinary film (see Figure II) of a patient's knee shows lack of structure in the left tibia (*osteitis fibrosa*). But the planigraphic films (Figure III), several of which are reproduced, reveal in addition the extent to which the progress has advanced, reducing the wall of the bone to the thickness of paper and even showing a perforation of the tibial articular surface at one point, thereby suggesting that the disease is sarcomatous and not cystic. In other cases a cyst in the femur becomes apparent, of which there is no trace on the ordinary film.

Similarly, in a case of a sarcoma of the tibia the destruction of bone structure is shown in detail on the planigraphic films, while in a case of atrophy of the knee, attributed for clinical reasons to tuberculosis, two foci become plainly visible on the planigraphic film which are not found on the ordinary skiagram. In this case tuberculous arthritis had been diagnosed on clinical grounds, but the X ray confirmation was very conclusive by this method.

FIGURE IV.

FIGURE V.

In cases in which the patella is affected, contact radiography is superior to the conventional method, but planigraphy again gives the most distinct results. Remarkable findings may also be obtained in the region of the pelvis. In a case of Perthes's disease, planigraphic films show that the head of the femur has actually taken the shape of a pointed hook (Figure V), a fact which cannot be suspected from the ordinary film (Figure IV); Figure IV (ordinary film) shows a far more unfavourable appearance than actually exists.

Of by far the greatest interest, however, are Janker's studies of the spine. Figure VA (ordinary X ray examination) shows a kyphotic spine caused by a wedge collapse of the second lumbar vertebra; but note that in Figure VB (planigraphic sectional film) there are defects in all the vertebræ, but especially the lower back part of the body of the twelfth thoracic vertebra. The importance of demonstrating the disk between the fifth lumbar vertebra and the sacrum has been stressed by A. Köhler, and if the lithotomy position cannot be used for this on account of ankylosis, then planigraphy is required. Not only can the intervertebral space between the fifth lumbar vertebra and the sacrum be shown with great simplicity, which is not always possible with ordinary films, but planigraphy also detects such defects of the vertebræ as are invisible by ordinary films. A further series of illustrations show that it is actually possible to reproduce only a single stratum of the cervical vertebræ, such as includes only the tips of the spinous processes, bodies or arches of the vertebræ. They are shown separately without interference by intervening parts. Similarly, atlas and

epistropheus, which cannot be shown invariably by ordinary methods, may be studied in detail in practically all pathological cases (Figure VI). The reproductions of X ray films are rather amazing in their conviction.

Janker refers briefly to the larynx and the sternum. The sternum is well shown in Figures VII, VIII and IX, and

FIGURE VA.

FIGURE VB.

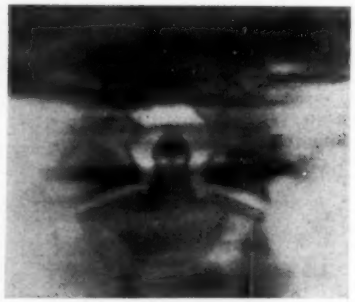


FIGURE VI.

is seldom satisfactorily shown by ordinary films. Figure VII shows a contact film of a metastasis in the sternum. Figure VIII shows the same case in a planigraphic film. Figure IX shows the whole of the normal sternum obtained by planigraphy. Janker then devotes special attention to the study of the skull. In three cases the exact position of small metal splinters is ascertained with great accuracy, and in a case of *leontiasis ossea* the enormous cross-section of the zygomata is plainly visible. Encephalography can also profit considerably from the planigraphic method, inasmuch as the

FIGURE VII.

FIGURE VIII.

FIGURE IX.

patient may be spared the frequent alterations of his position. A parasagittal tumour can thus be shown distinctly with great ease, and even the convolutions of the brain sometimes become visible. Here it should largely replace stereoscopy or at least supplement it.

Finally, a number of X ray films are produced illustrating the efficacy of the planigraphic examinations in diseases of the chest. This, we are reminded, is the region for which the method was originally introduced by Chaoul. Of special interest is a case in which neither the normal skiagram nor the application

of a Bucky diaphragm revealed the large cavity, which is well seen on the planigraphic film. Again, in a case of a lung abscess the cavity is shown only by planigraphy. The new method is also used to advantage in bronchography. It is well known that the introduction of opaque media into the bronchi is very trying, particularly for those who are very ill. Planigraphy is able to show bronchiectasis *et cetera*, just as well as opaque oils, but without any inconvenience for the patient. Some films accompanying the paper verify this claim.

Summarizing his results, the author states that planigraphy, if applied with criticism and objectivity, is likely to become of great value in medical diagnosis.

THOMAS KING.[1]

SPINAL ANÆSTHESIA IN CHILDREN.

Professor Aoyama, Tokio: *"Zur Lumbalanästhesie bei Kindern"*, *Der Chirurg*, October 15, 1936.

PROFESSOR AOYAMA points out that, although infancy is generally given in the textbooks as a contraindication for spinal anæsthesia, there is no evidence of ill-effects from its use to support this view. On the contrary, many observers hold that it is incorrect. His own material consists of 792 children under the age of fifteen, in the treatment of whom it has been successfully used, the youngest being three months of age. He has had only one accident; this occurred in a patient with an open infection near the spine, and in this instance the method should never have been used.

Serious falls in blood pressure do not occur in young children; backache and headache are rare and transitory; and the most likely complication, the restlessness of the child, is not at all usual, since most of them sleep through the operation. A preparatory injection of morphine and atropine is given to children over three or four years of age, and as a rule a short general anæsthetic is given during the spinal puncture. The puncture is done with the patient in the lying lateral position. "Nupercaine" (Ciba) in 0·5% solution is used as the anæsthetic agent; a measured amount is put into a syringe into which a calculated amount of cerebro-spinal fluid has been drawn off, and the mixture is reinjected. The operation is started twenty minutes later. The extent of the anæsthetic area obtained can be varied by varying the amount of fluid injected, as well as by altering the site of the puncture. In children under two years of age, Aoyama holds that no attempt should be made to carry the anæsthetized area higher than the umbilicus, unless the surgeon has had a good deal of experience of the method. In these young children the third lumbar space is always used for the puncture. As to the dose given, children under two years of age received 0·25 cubic centimetre of a 5% solution of "Nupercaine"; above that age 0·1 cubic centimetre is given for each year of the child's age. The amount of mixed cerebro-spinal fluid and "Nupercaine" also is worked out. Under two years it is 2·5 cubic centimetres; above that, 1·0 cubic centimetre is added for each year of the child's age up to seven. All children from seven to twelve years old receive 7·0 cubic centimetres, while from thirteen to fifteen years of age they are given 8·0 cubic centimetres of total mixture. Tabled, the dosage is as follows:

Age of Child.	Dose of 5% "Nupercaine" in Cubic Centimetres.	Total Amount of Mixed Cerebro-spinal Fluid and "Nupercaine" Injected in Cubic Centimetres.
1 year	0·25	2·5
7 years	0·7	7·0
13 years	1·3	8·0

Movements of the child must be eliminated as much as possible, as with adults; but if proper precautions are taken and cases are well chosen, ill-effects are rare and the anæsthetic will be found to be very satisfactory.

ARTHUR E. BROWN.

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[1] The reviewer acknowledges the assistance of B. C. Drude in preparing this abstract.

CARCINOMA OF THE RECTUM.

Dr. H. W. Pässler, Assistant in the Surgical Clinic, University of Heidelberg (Director: Professor Kirschner): *"Das Schicksal von 282 Kranken mit Mastdarmkrebs bei verschiedenen Behandlungsverfahren"*, *Der Chirurg*, February 15, 1935.

PÄSSLER gives an account of his investigation of the fate of 282 patients suffering from carcinoma of the rectum after treatment by various operative methods. Of the 282 patients, 122 had radical operations. Of these radical operations, about half consisted of the sacral and half the one-stage abdomino-perineal operation, with formation of an artificial anus. Many of the sacral operations were two-stage procedures, in which, at first, an exploration of the abdomen was made and an abdominal artificial anus was formed, the rectum being removed at a later period by the sacral route. Since 1933 the abdomino-perineal operation was carried out by Kirschner's synchronous method. (This was described in THE AUSTRALIAN AND NEW ZEALAND JOURNAL OF SURGERY, Volume v, 1935-36, page 195.) The post-operative mortality rate for the 122 radical cases was 27%, and for the sacral operation 12·5%. In exactly the same circumstances—operative technique, indications, pre-operative and post-operative treatment—65 patients were operated on by the sacral and abdomino-sacral methods. Thus a comparison of the results of these two methods of operation was possible, a comparison which would be possible in few clinics. The combined operation had a mortality rate of 35%; the sacral operation a mortality rate of 18%. Finally, with improved technique, in Kirschner's clinic it was possible to reduce the mortality rate of the combined abdomino-perineal operation to 25%, but it still remained twice as high as the sacral operation carried out during the same period. Kirschner found that shock in the one-stage combined operation was especially severe. The result of Pässler's investigations showed that the mortality for the sacral operation was so low that he would regard it as the operation of choice; and that, unless the one-stage combined abdomino-perineal operation could give much better possibilities of permanent five or ten-year cures, it was not justifiable to employ this operation, because its immediate mortality was so very much higher. The increased mortality of the abdomino-perineal operation negatived the value of any lasting cure it might confer on the patient. In order to find out what the ultimate healing results of these two methods of operation were, Pässler investigated the ultimate results in 71 patients who lived in the town in which the clinic was situated. All the patients were radically operated on, some by the sacral, some by the abdomino-sacral methods. Considering the operation mortality rate as well as the ultimate mortality rate, Pässler found that, in the combined proceedings, 30% of the 71 patients submitted to radical operations (both sacral and combined) were brought to a reasonably permanent cure, as against 35% in the sacral proceeding. He draws the conclusion that the effort to obtain more lasting cures by means of the combined radical operation is without result. He arrives at the opinion that the best proceeding is to undertake a first stage operation—abdominal incision, exploration of the abdomen, and the formation of an artificial anus—and, following this, in a second stage to extirpate the rectum by the sacral route. He thinks that only in a highly situated carcinoma and with a patient in relatively good condition should combined proceedings be used, and that then only the synchronized form of operation should be employed.

H. B. DEVINE.

Reviews.

THE THYREOID.

The Thyroid: Surgery, Syndromes, Treatment. By E. P. SLOAN, M.D., with a foreword by W. S. BAINBRIDGE, M.D.; 1936. London: Baillière, Tindall and Cox. Double crown 9mo, pp. 483, with illustrations. Price: 45s. net.

E. P. SLOAN'S monograph, "The Thyroid: Surgery, Syndromes, Treatment", is a disappointing book in that, though the author devoted twenty-five years of his

life to goitre work, he has failed to give any useful information about the results of this work.

The chapters on ætiology and prophylaxis are, in the main, rather indefinite summaries of the literature, and the author's opinions, when given, are nebulous in character. A large part of the book is devoted to surgical anatomy and operative technique, both of which might well be omitted from monographs on this subject. The chapter on the thymus contains some interesting case histories of tumours of this organ treated by surgical removal, and the book ends with an historical summary and an assortment of classifications of thyreoid disease, including, as usual, that adopted by the author.

The book cannot be recommended for general use, though surgeons who work in this field may find something of interest in it.

PRACTICAL ANATOMY.

A Manual of Practical Anatomy. Part III: The Head and Neck. By T. WALMSLEY; 1936. London: Longmans, Green and Company. Medium 8vo, pp. 357. Price: 12s. 6d. net.

THIS book, as stated in the preface, is primarily a directory of dissection for medical students. It constitutes the third volume of a series. A description of the method of dissection is set out, but it would not be practicable unless the other two volumes of this work were utilized in the dissecting room at the same time. The nomenclature is that adopted by the Anatomical Society of Great Britain and Ireland.

The line drawings are clear and accurate. There are some mistakes in the letterpress, and it is difficult to see of what use reproductions of skiagrams of the skull can be to the medical student. This is yet another dissecting manual in which the author attempts to combine a system of dissection with a certain amount of systematic description; it would be quite satisfactory if the other volumes were used in conjunction with it.

ZINC, CANCER AND TUBERCULOSIS.

Tuberculosis, Cancer and Zinc: An Hypothesis. By D. B. CRUICKSHANK, L.R.C.P. & S., L.D.S., D.P.H., with an introduction by SIR P. VARRIER-JONES, M.A., F.R.C.P.; 1936. London: Medical Publications Limited. Demy 8vo, pp. 86, with illustrations. Price: 7s. 6d. net.

IN this interesting little book the author has collected a great deal of information of an out of the way kind which will probably be new to most readers. The collection of this material and the associated literature makes it an entertaining, if not an instructive, contribution to the literature.

The first chapter gives an account of the part that zinc appears to play in animal metabolism. The absorption and excretion of this element, its occurrence in the tissues both in normal and abnormal conditions, and the effects of too small or too great amounts are all discussed. In the second chapter the distribution of zinc in various parts of the world and the incidence of tuberculosis are shown by the author to be related in that tuberculosis appears to be most prevalent in those areas where zinc is relatively deficient, and *vice versa*. The author comes to the conclusion that zinc deficiency plays some part in the development of tuberculosis.

In the last two chapters the writer discusses the relationship between tuberculosis and cancer, showing that statistically the mortalities from these diseases are reciprocal.

Towards the end of the book there are many statements which are so arresting and which are made in such a way that one must turn repeatedly to the summary at the beginning to reassure oneself that the statement that the work is in the nature of an hypothesis is really there.

Although the information is interesting, the volume and wealth of hypothesis are overwhelming. One statement is of importance: "The main part of this hypothesis is based on one assumption, *viz.*, that in tuberculosis there is a defence mechanism analogous to the bacteriophage defence in intestinal infections with the typhoid group of organisms, and that this particular phage is itself pathogenic to man." Surely one may arrive at startling conclusions with premises even less far-reaching than this.

DISEASES OF THE TESTICLE.

Diseases of the Testicle. By H. BAILEY, F.R.C.S.; 1936. London: H. K. Lewis and Company Limited. Demy 8vo, pp. 168, with 129 illustrations. Price: 12s. 6d. net.

HAMILTON BAILEY'S book, "Diseases of the Testicle", is one of the best monographs it has been our fortune to read. It is beautifully illustrated by photographs and by coloured and semidiagrammatic plates. It is very concise and contains much more information than is to be found in many books twice its size. A pleasing feature is a list of standard works of reference at the end of each chapter. This plan always enhances the value of such books, and it is a pity that it is not more generally followed. The writer, too, has the happy knack of making the subject-matter very interesting and readable by the use of appropriate anecdotes and historical references. For example, there is an interesting reference to the tragedy of one of Sir Astley Cooper's students and also to the choir of Saint Peter's, Rome. The first six chapters deal with development and with the problems associated with imperfect descent of the testes; these are very well done. A full review of the operative procedures is given, the author being a protagonist of operation on patients between the ages of seven and eleven years. Hydrocele of various types and varicocele *et cetera*, are dealt with in a succinct manner, but the chapters contain all that need be known by any except experts.

The chapter dealing with testicular neoplasms is rather short, but very little of practical importance is omitted. The writer does not emphasize sufficiently the importance of palpating the epididymis or of picking up the tunical layers in the differential diagnosis between neoplasm and hæmatocele or chronic hydrocele. He is in favour of radical operation in the treatment of these tumours, although it is fairly generally admitted nowadays that this is of questionable value. The great value of deep X ray treatment in the seminoma type of tumour is, however, emphasized, and the use of the hormone test of the patient's urine is advocated for the purpose of estimating the value of this mode of treatment. The chapter dealing with trauma and torsion is complete and is illustrated by several good case histories. The author is an advocate of a prophylactic operation on the unaffected side after one side has undergone torsion, although it would seem that the operative technique suggested is rather unnecessarily difficult.

The last two chapters are very interesting, and deal with the question of sterility and rejuvenation.

The book is very well produced. There are very few errors either of construction or detail, there is not a line of extraneous matter in the volume, and it is packed with clinical information and practical facts in respect of both diagnosis and treatment. It should be in the hands of every practitioner who meets with lesions of the testicle.

WILLIAM REDFERN: A DRAMA.

The Emancipist: An Historical Drama in Three Acts. By J. M. ANTILL, C.B., C.M.G., and R. ANTILL-DE WARREN; 1936. Australia: Angus and Robertson Limited. Crown 8vo, pp. 182. Price 3s. 6d. net.

"THE EMANCIPIST", the first Australian historical play to be published, is of particular interest to members of the medical profession, as it is the story of

the life of the first Australian medical graduate, William Redfern. Few men have lived lives so full of experience, and have overcome such great difficulties as Redfern. The story of the principal incidents in Redfern's life is entertainingly told in "The Emancipist". The interest of the reader is retained during the whole play. Conditions existing during Sydney's early history are faithfully depicted. This play should be read by all lovers of Australian history and literature.

THE OPERATIONS OF SURGERY.

The Operations of Surgery. By R. P. ROWLANDS, M.S., F.R.C.S., and P. TURNER, B.Sc., M.S., F.R.C.S.; Eighth Edition. London: J. and A. Churchill Limited. Volume I; 1936. Royal 8vo, pp. 1055, with 435 illustrations, of which 38 are in colour. Price 36s. net. Volume II: The Abdomen; 1937. Medium 8vo, pp. 1007, with 514 illustrations, 4 of which are in colour. Price: 36s. net.

THE description of the advances in operative surgery in the last nine years would fill a book of moderate size and would be no inconsiderable task. The task is no less when the object is to bring up to date so honoured a textbook as "The Operations of Surgery", by Rowlands and Turner. All surgeons who have learned to look to Rowlands and Turner for balanced judgement and advice, as well as for the technical details of operations, should feel pleasure in the arrival of the eighth edition.

Disappointment is often the lot of those who expect much. In this instance there is room for disappointment in many sections, but on the whole the alterations and additions have maintained the old standard. During the time intervening between these two editions, intracranial surgery has made great advances, and most surgeons doing this work have adopted in principle the techniques of Cushing. It is therefore more than disappointing to find no mention of modern means of controlling hæmorrhage during these operations, such as by clips, muscle stamps and electro-coagulation. The surgeon who embarks on such operations must necessarily be familiar with such techniques. Likewise an almost archaic section is devoted to cerebral localization, and no mention is made of ventriculography and encephalography for this purpose. The classification of intracranial tumours given has long been abandoned. Further, the reader will be most surprised to find a reference to Cushing's record of 124 cases up to 1915, while his experience to 1935 with 2,000 cases is ignored.

Gas and oxygen, the almost universally used anæsthetic for intracranial operations, is not mentioned, and the armamentarium of instruments, though it includes several useless and dangerous pieces of apparatus, does not include "brain needles". It is only fair to state that this chapter falls far below the general standard of the book and badly needs revising.

It is also surprising in other chapters to find no mention of tube grafting under the discussion of skin grafts, or of embolectomy in the section on blood vessel surgery. The section on operations on the fifth nerve would be improved by the elimination of long descriptions of operations now generally abandoned, and by a more detailed description of section of the sensory root, the operation now generally preferred. The chapter on the tongue is good, and has been greatly improved by inclusion of a good discussion on radium treatment. Likewise, the pharyngeal section has been amplified, and Trotter's operation has been well described. The section on thyreoid surgery is very good, but there is no mention of the surgery of the parathyreoids. That very important branch of work, surgery of the cervical sympathetic system, is not mentioned. A description of the radium treatment of breast cancer has been included, and the section on thoracic surgery has been brought up to date. The Smith-Petersen method of treatment of fractures of the femoral neck is well described.

In the second volume considerable additions have been made in several sections. The chapter on hernia has been amplified and rearranged along the

lines of most modern thought and practice. It is refreshing to find this chapter prefaced by a sound description of the anatomy of hernia. This is one of the few books in which such a description is to be found. As some new techniques have been added to this chapter, some of the old operations have been omitted.

In the sections on intraabdominal operations there is slight but important rearrangement. The section includes discussions on treatment of cardiospasm, in which operation on the sympathetic nerves is somewhat surprisingly omitted. The discussion of intestinal obstruction is amplified. The question of the delayed treatment of appendicitis which might reasonably have come within the scope of this work, is not considered. The chapter on rectal surgery is much improved, and includes descriptions of new techniques, such as the perineo-abdominal resection, and Devine's and other restorative operations.

There is a new addition on surgery of the lumbar and sacral sympathetic systems. A final chapter, dealing with some recent developments in head and chest surgery and other techniques, makes some amend for certain notable omissions elsewhere.

On the whole the book has maintained its high value, though some of the sections, as we have shown, are much behind the general standard; this is to be regretted.

Proceedings of the Royal Australasian College of Surgeons

VICTORIAN ANNUAL MEETING.

THE yearly meeting for the State of Victoria was held at the Royal Melbourne Hospital on Wednesday and Thursday, September 1 and 2, 1937. The following programme was presented:

Wednesday, September 1, 1937.

10 a.m.—Operations:
- W. G. D. Upjohn: Bone graft.
- W. Allan Hailes: Carcinoma of colon.
- R. W. Chambers: Gynæcological operations, demonstration of cases.

1.30 p.m.—Lecturette:
- W. Allan Hailes: "Cellulitis of the Colon: A Manifestation of Diverticulitis."

2.30 p.m.—Operations:
- Julian Smith, junior: Stone in ureter.
- C. W. B. Littlejohn: Operation for tennis elbow.
- John Turner: Anal operations.

4.15 p.m.—Lecturette:
- A. E. Coates: "The Surgery of Cerebral Tumours."

Thursday, September 2, 1937.

10 a.m.—Operations:
- Victor Hurley: Carcinoma of breast, demonstration of cases of exophthalmos.
- Henry Searby: Operation for peptic ulcer.
- John Shaw: Oto-rhino-laryngological operations, demonstration of cases of carcinoma of bronchus.

11.30 a.m.—Lecturette:
- Henry Searby: "Surgical and Anatomical Principles in Operations for Inguinal Hernia."

2.30 p.m.—Operations:
Sir Alan Newton: Exophthalmic goitre.
E. S. J. King: Gastrostomy, demonstration of method of feeding.
Harold Moore: Removal of renal calculus, demonstration of urological cases.

4.30 p.m.—Lecturette:
G. R. A. Syme: "Management of Hæmatemesis."

On the evening of Thursday, September 2, 1937, Professor G. Grey Turner, M.S., F.R.C.S., F.A.C.S., Professor of Surgery at the British Postgraduate Medical School, delivered the Victorian annual lecture, taking as his subject "Some Aspects of Œsophageal Surgery". At this meeting an honorary fellowship was conferred on Professor G. Grey Turner.

Professor G. Grey Turner delivered the following message from the Royal College of Surgeons of England:

"Mr. Vice-President and members of the Council: I have been entrusted with the happy task of conveying to you a message of greeting and goodwill from the Royal College of Surgeons of England.

"It is always a pleasure to our Council to watch your activities and to be witness to your enterprise, which we so much admire.

"Though we sometimes envy you in that you are untrammelled by precedent, we only do so in the spirit of friendliest cooperation and warm regard.

"As a result of my visit I shall be able to report on your good health and vigorous development, which will give much pleasure to our President and Council at home."

VICTORIAN EVENING MEETING.

ON the evening of Friday, July 30, 1937, a discussion on the subject of "Problems in Appendicitis" was held at the College. The following papers were delivered: (i) "The Time to Operate", by W. A. Hailes; (ii) "The Incision", by Balcombe Quick; (iii) "Drainage in Acute Appendicitis", by Sir Alan Newton; (iv) "The Treatment of Paralytic Ileus", by Dr. Ian Wood.

A very profitable discussion followed these papers.

NEW SOUTH WALES EVENING MEETING.

THE New South Wales Committee arranged a meeting on the evening of Tuesday, September 7, 1937, at the Robert H. Todd Assembly Hall, British Medical Association House, at which Professor G. Grey Turner gave an address entitled "Late Results of Transplantation of the Ureters".

OPENING OF PRINCE HENRY'S HOSPITAL POST-GRADUATE SCHOOL OF SURGERY.

THE Prince Henry's Hospital Post-Graduate School of Surgery, which will be conducted under the direction of the Royal Australasian College of Surgeons, was formally opened by Professor G. Grey Turner on the afternoon of Tuesday, August 31, 1937. Professor G. Grey Turner delivered an address entitled: "Surgical Post-Graduate Education." Although the school has been officially opened, it will not be possible for post-graduate teaching to be carried out until the second unit of the hospital rebuilding scheme is completed, probably towards the end of 1938.

On the evening of Tuesday, August 31, 1937, Fellows of the College and members of the honorary staff of Prince Henry's Hospital entertained Professor G. Grey Turner at dinner at the Hotel Windsor, Melbourne.

NEW SOUTH WALES STATE COMMITTEE.

AT a meeting of the Council of the College held on Tuesday, August 31, 1937, the resignation of Guy Antill Pockley as a member of the New South Wales State Committee was accepted with regret.

The Council desires to place on record an expression of its appreciation of the services rendered to the College by Guy Antill Pockley while a member of the Committee.

The Council has appointed V. M. Coppleson as a member of the New South Wales Committee to fill the vacancy caused by the resignation of Guy Antill Pockley.

WESTERN AUSTRALIAN HOSPITAL COMMITTEE.

THE Council has appointed J. P. Ainslie, F. J. Clark and H. H. Stewart members of a Western Australian Hospital Committee.

Notices.

THE BRITISH POST-GRADUATE MEDICAL SCHOOL.

THE College wishes to draw attention to the announcement of the British Post-Graduate Medical School on page xxx of the advertisements.

NEW DEVELOPMENTS IN SURGICAL EQUIPMENT.

THE attention of Fellows is drawn to pages xviii and xxvi among the advertisements, which illustrate some recent developments in surgical equipment. The Editorial Committee is responsible for the selection of the equipment illustrated thereon. The publishers will be pleased, whenever possible, to supply the names and addresses of the manufacturers to anyone requiring such information.

Editorial Notices.

EDITORIAL communications should be addressed to the Chairman of the Editorial Committee, 57 Collins Street, Melbourne, or to any member of the Editorial Committee. It is understood that original articles forwarded for publication are offered to THE AUSTRALIAN AND NEW ZEALAND JOURNAL OF SURGERY solely, unless the contrary be stated.

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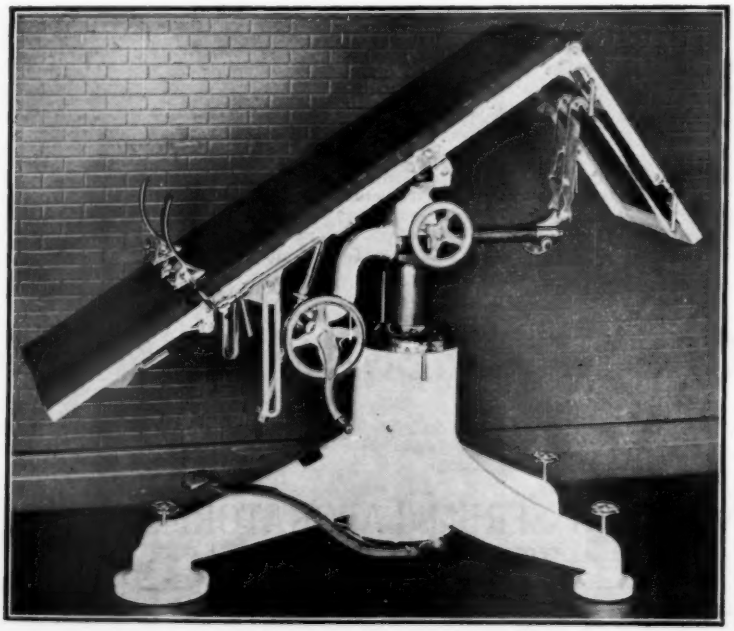

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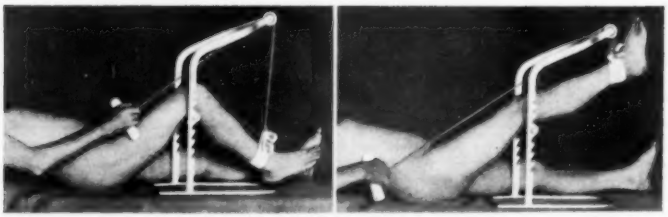

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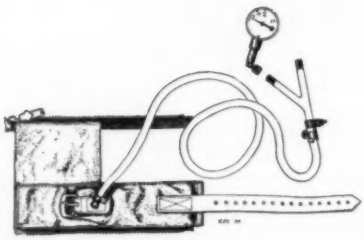

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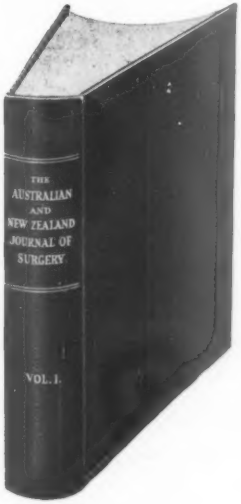

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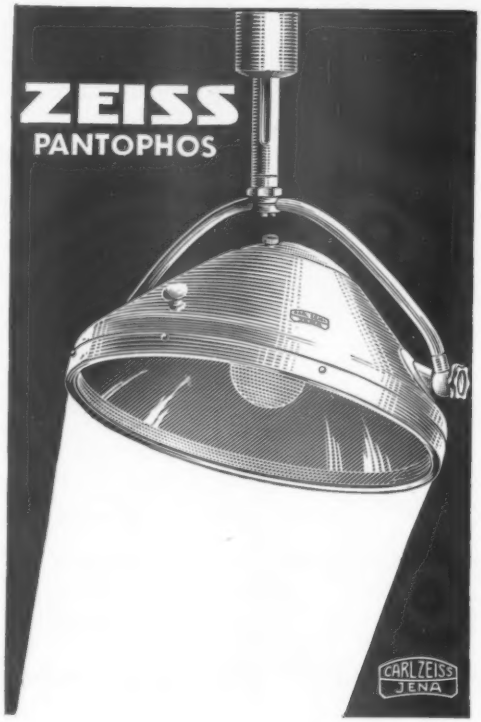

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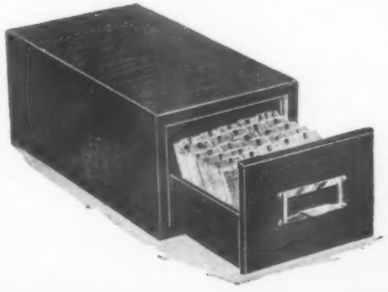

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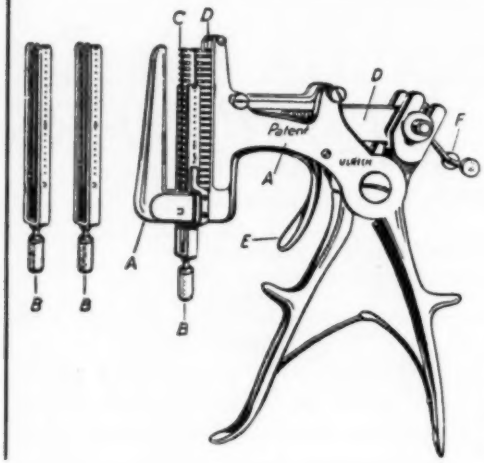

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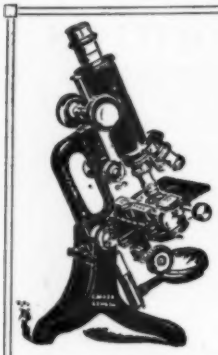

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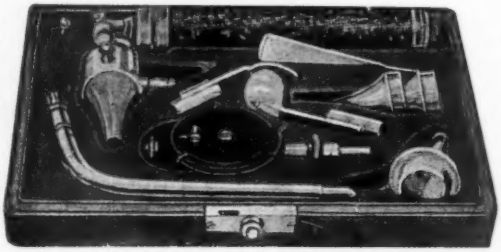

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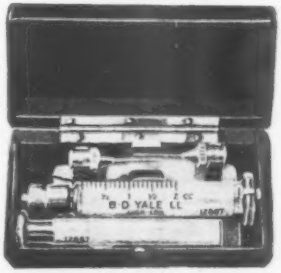

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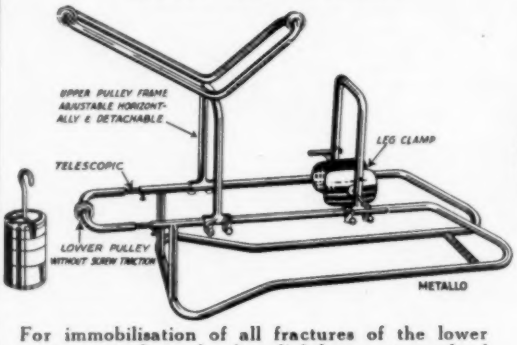

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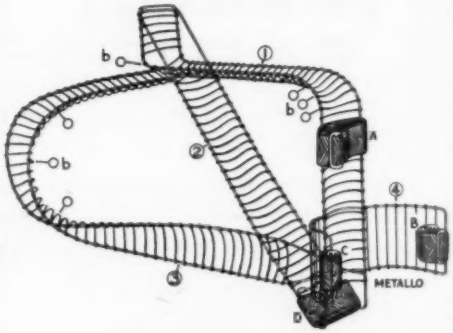

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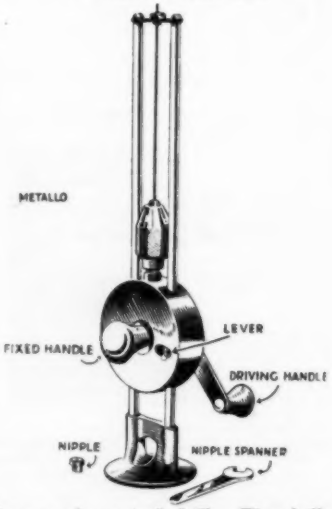

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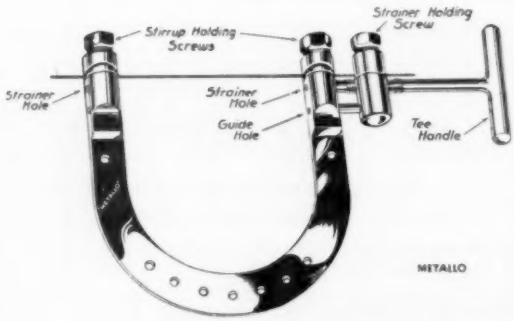

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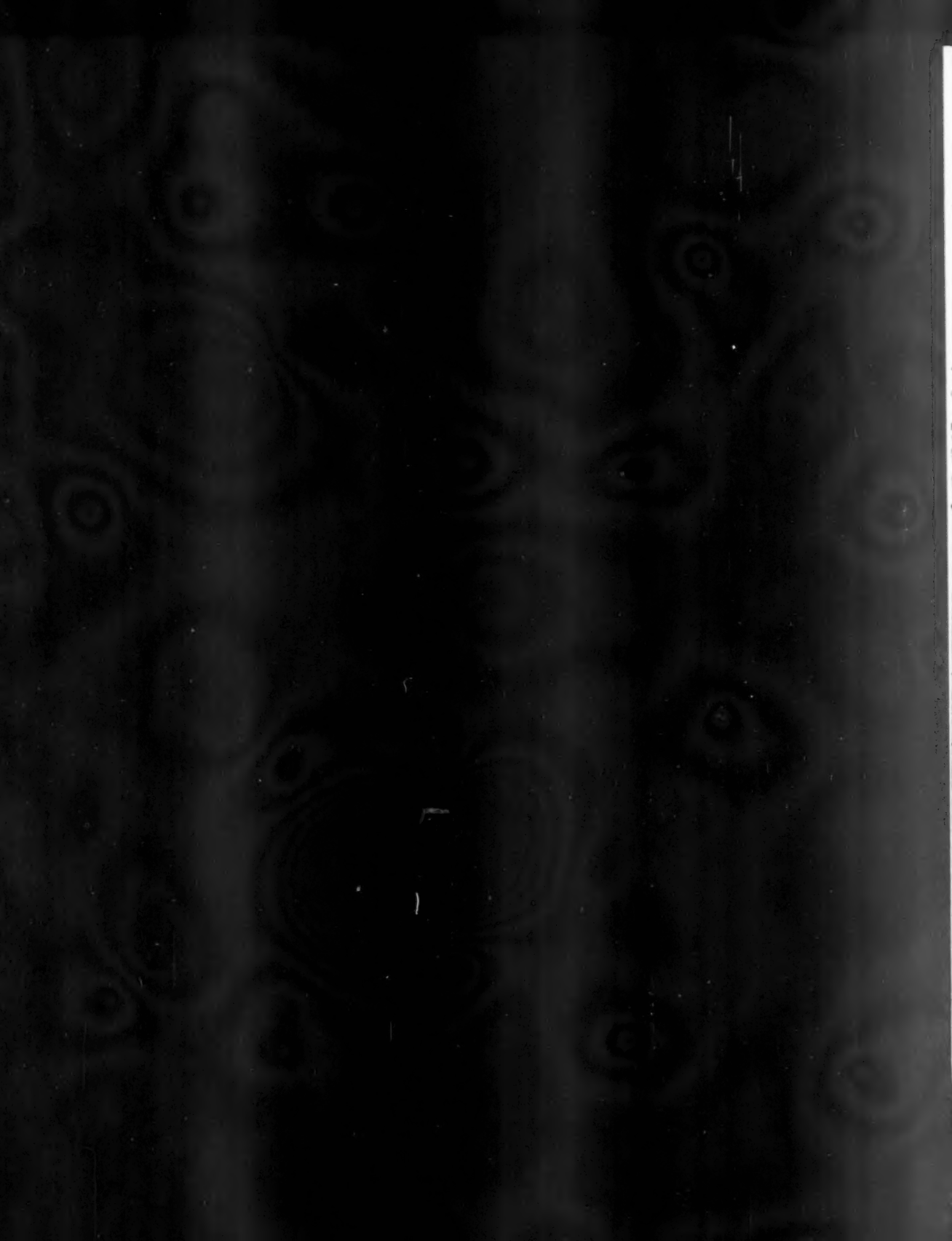

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